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June 2015
Issue 416

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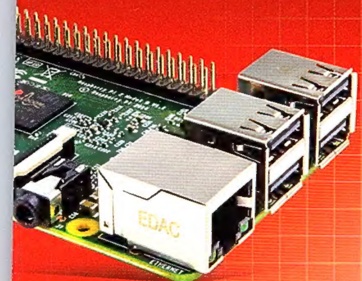

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MINI PC IN YOUR POCKET

Will your next PC be the size of a USB key?

SILENT BUT DEADLY

Detailed guide to crafting a quiet but beastly desktop PC

REVIVE YOUR OLD TECH!

FIND PRACTICAL NEW USES FOR YOUR OLD SMARTPHONE, TABLET, PC, LAPTOP, ROUTER, MONITOR + MORE!

STIMULATING HOW-TOs:

- Reclaim iPhone or iPad storage space
- Host your own chat server
- Customise the Win 8.1 lockscreen

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- The snappy new mini: Intel's latest NUC PC
- Best apps for PC, iOS, Android, Mac & Linux

NEXT-GEN SOLID STATE

Intel's new 750-series SSD breaks all the storage speed limits!

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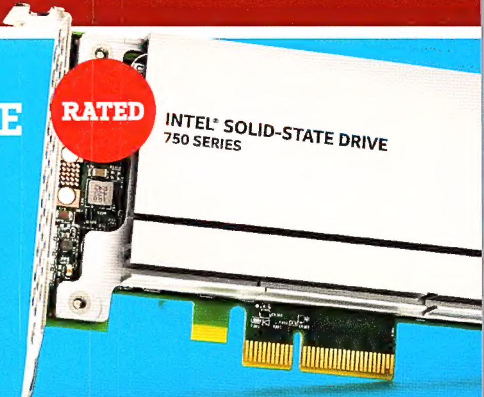

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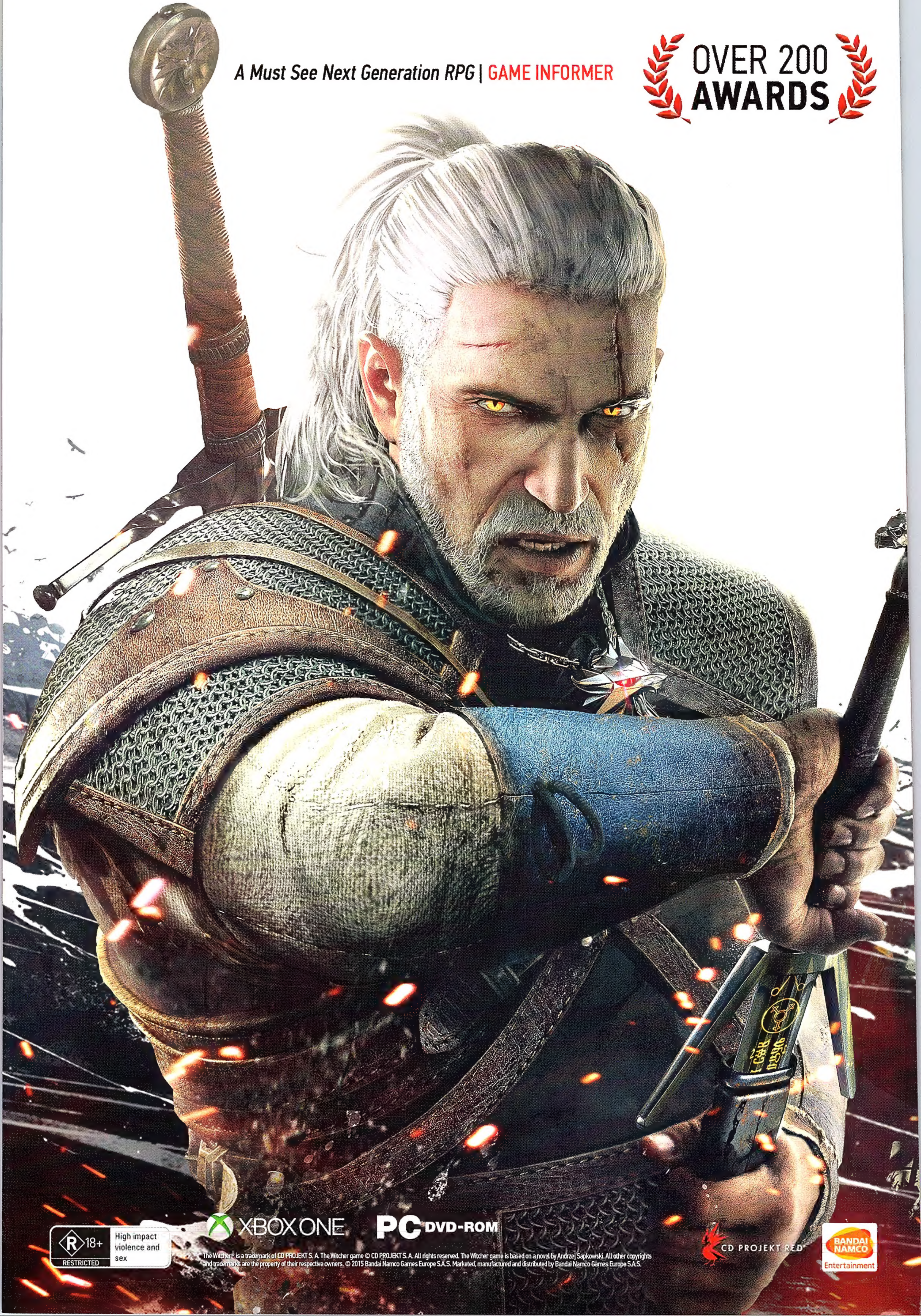
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Practical ways to re-use your tech

APC's editor is an unrepentant tech horder... but it's not a problem. Really.

One of the perks – and curses – of being a technology enthusiast is that there's basically always something bigger and better just around the corner. With companies like Samsung, Apple and Intel releasing new flagship devices on a yearly basis, sometimes it can be hard to keep up.

But while we joke about how quickly technology becomes obsolete, that doesn't mean your old gear can't be useful once it's passed its prime. It's with only a slight twinge of shame that I admit to having a few too many leftover PC parts, gadgets and PCs than I probably should have... to my significant other's great dismay. (Ladies and/or gents be warned; this is what you get from marrying the editor of a computer magazine.) In my defense, some of them do sometimes come in handy... the streaming TV we have in the bedroom is built using an old 27-inch monitor, stereo PC speakers and an Intel NUC running Ubuntu, for example.

And that's just one use for a few spare bits I had lying around. I also have a stack of smartphones (and even a couple of tablets) that are still perfectly functional.

With that in mind, this issue we decided to put together a comprehensive guide to re-using your old gear. As you'll find (starting on page 45), there's a heap of projects you can do that will put your devices back to work in practical ways.

Of course, there are probably a few items in your collection of gadgets and other tech detritus that look more like they belong in a museum than being actually re-usable. If that's the case, you'll also find a guide on where you can safely dispose of these – or even make a buck or two – on page 64.

Whatever you decide to do, we hope this month's tutorials help spark a few ideas of your own. And if you've found a cool way to re-use your old gear, let us know about it at **apcmag@futurenet.com** – if it's cool enough, we'll share it with other readers! ■

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apc

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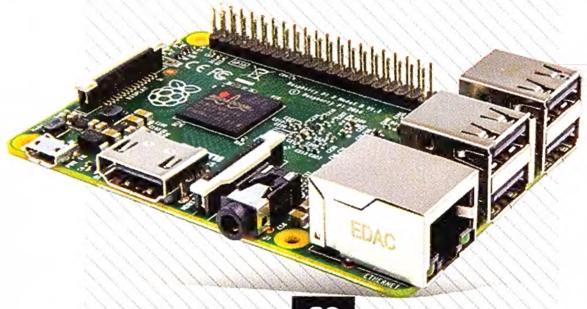

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RASPBERRY PI THE BEST NEW PROJECTS

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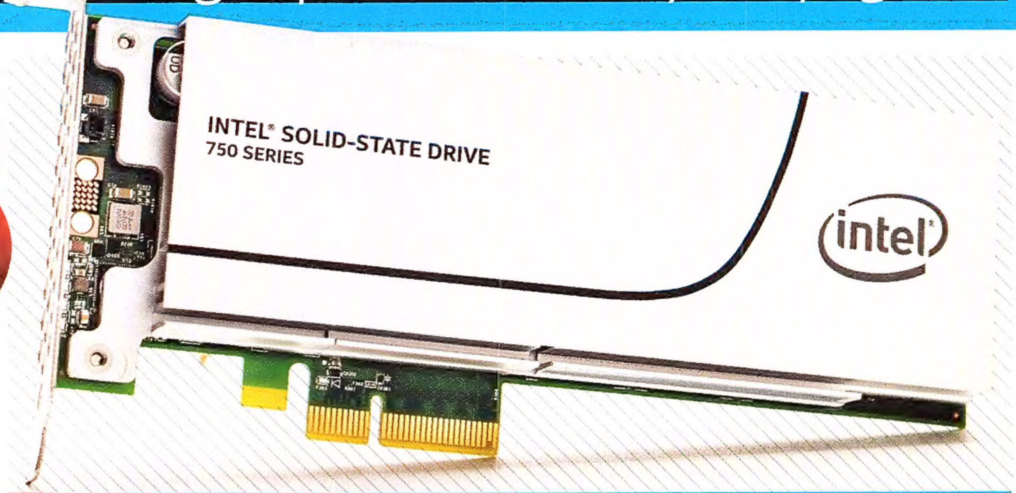

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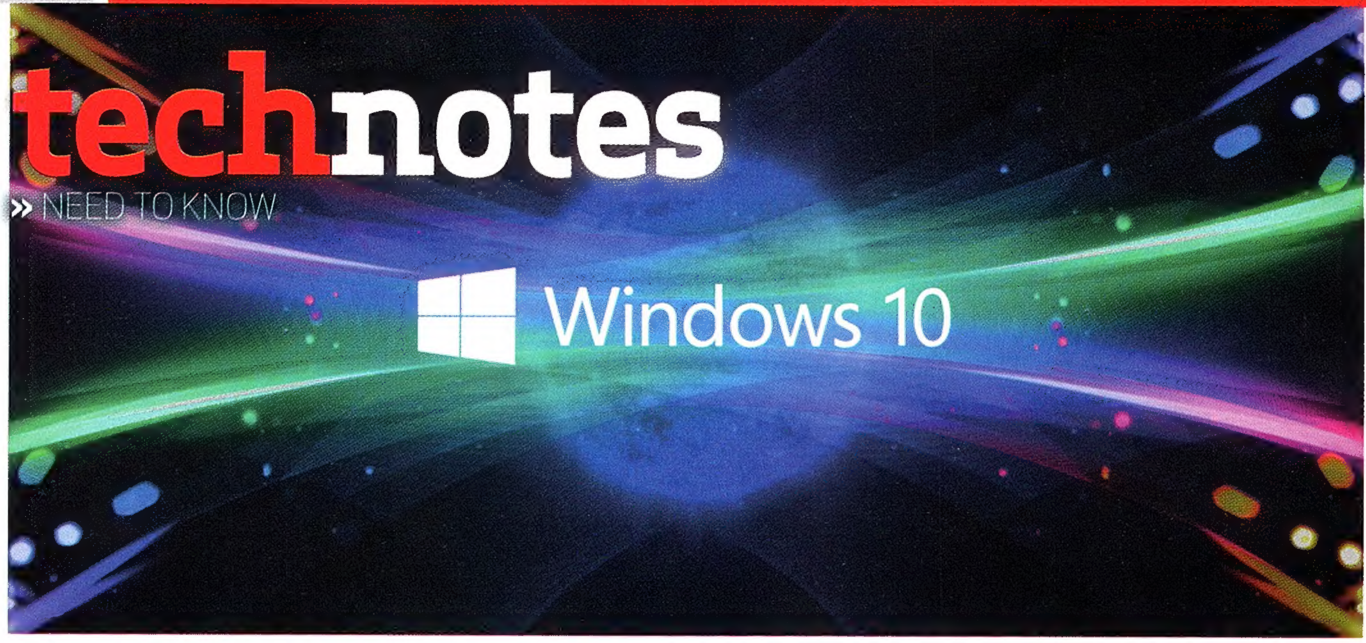


More Windows 10 details revealed

All the news from Microsoft Build Conference 2015.

If you can't beat 'em, join 'em – after struggling for years to keep up with its competitors' app offerings, Microsoft is pulling out the big guns to make Windows 10 a desirable platform for developers. Its first order of business is to make it possible to bring reworked iOS and Android apps to Windows 10 mobile.

Microsoft wants to encourage development on the Windows 10 platform by adding support for the Objective-C programming language used most-notably in OS X and iOS development. Android apps will be brought to the platform via emulation and through Java and C++ code.

Developers would be able to integrate Windows specific capabilities like Cortana, Xbox Live, HoloLens and more into their apps while still retaining their original APIs.

The single platform approach that Microsoft has adopted for Windows 10 will also allow a Windows 10 smartphone to act as a complete desktop computer. Dubbed Microsoft Continuum, the interfaces of Windows 10 devices will scale and adapt depending on what they're connected to. An on-stage demonstration by Microsoft's Joe Belfiore showed a Windows 10 phone immediately reconfigure itself into a more traditional desktop layout when connected to a monitor, keyboard and mouse.

Microsoft also revealed its much-anticipated Internet Explorer successor, titled Microsoft Edge. The browser will be available on all devices that support Windows 10, including desktop computers, tablets and smartphones.

Edge allows the user to take notes by drawing right on the browser window as well as on Microsoft documents. It will also include a Reading Mode that removes everything except text and images from a web site, as seen in recent versions of Safari. Cortana voice assistant support will also be included.

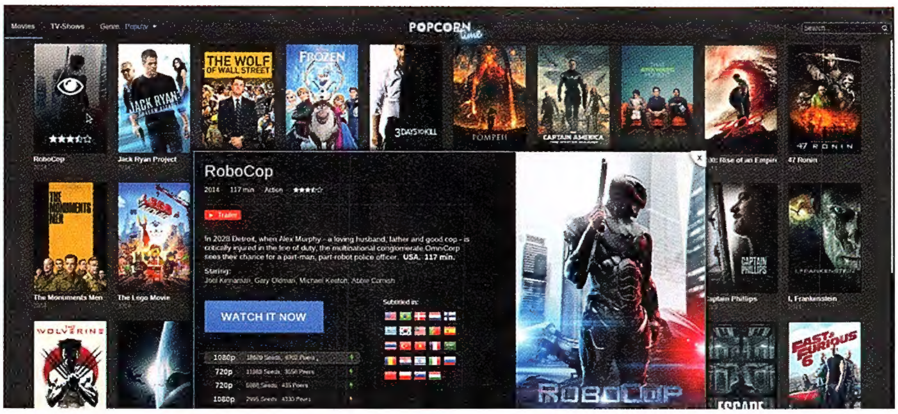
Browser extensions are also coming to Microsoft Edge. Developers will be able to port Chrome extensions over to Edge with only a few minor tweaks. While the browser won't launch with extension functionality, it is expected to arrive later in the year. Microsoft has stated that extensions will be available through the Microsoft Store. **Stephen Lambrechts**

Paid game mods cause dumptruck of feedback

Valve and Bethesda to rethink monetising.

PC-gaming giants Valve and Bethesda have been forced to do an abrupt about-face after their launch of a paid option for community-made gaming modifications drew widespread criticism. The scheme, which launched in late April, let mod-creators optionally set a price for content they had created for *Skyrim*, Bethesda's massively popular single-player RPG. Previously, all mods had been available for free, letting players add and change most facets of the game which led a large community to form around the game in the years since its release. Almost immediately, that community reacted negatively to the introduction of paid-mods, believing that it undermined the open nature of the modding scene. Despite initially defending the move, within three days the plan was pulled, with a Valve employee speaking on behalf of the company saying that it appreciated the 'dumptruck of feedback' that the *Skyrim* community had delivered to its inboxes — although it still believed that paid mods could help the community. Much of the disapproval stemmed from the notion that paid mods were intended to nurture the modding community and give back to contributors, but under this scheme mod creators only received a 25% cut of the sale price. Monetising mods in this way has worked in the past with, for example, *Portal 2's Aperture Tag* mod, but springing them on an established community crossed a boundary that gamers weren't happy about. **Joel Burgess**

No Paid Mods



In 2028 Detroit, when Alex Murphy – a loving husband, father and good cop – is critically injured in the line of duty, the multinational conglomerate OmniCorp sees their chance for a part-man, part-robot police officer. USA. 117 min.

The UK has no time for Popcorn

Courts block web sites hosting popular piracy application.

A court in the UK has ruled that four web sites allowing users to download the popular movie and TV-piracy application Popcorn Time must be blocked by the nation's ISPs. In April, the UK High Court ordered that Sky, BT, EE, TalkTalk and Virgin Media all block access to four variants of sites that facilitate Popcorn Time application downloads. Similar blocks have been issued in the past on sites including The Pirate Bay, KickassTorrents and EZTV. In those previous examples, however, rather than inhibit access to hosted content, these blocks spurred a torrent of new proxy sites that allowed users to circumvent the government-mandated restrictions. And while these new site blocks may prevent future subscribers from downloading the application, Popcorn Time is a peer-to-peer file sharing application, which means the court restrictions will not affect users who already have the application installed. Popcorn Time was originally created by a group of developers in Argentina, but after it was kicked from Mega — a New Zealand-based file hosting service run by controversial tech mogul Kim Dotcom — the free open-source application has been maintained by an anonymous community from all around the world, making it significantly harder to stop. **Joel Burgess**

Biohacker implants NFC chip in his hand

Uses it to hack Android phones and sneak past security.

In a story fit for a '90s Keanu Reeves movie, engineer Seth Wahle has demonstrated how simple it is for hackers to bypass security checks and take complete command of Android phones with the use of an NFC chip implanted in his hand.

The practice is called 'biohacking' and it involves the insertion of computing devices under a person's skin in order to sneak past digital and physical scans. In this case, the NFC chip (hidden in the flesh between Wahle's thumb and forefinger) would ping any Android phone in its vicinity, asking them to open a link. Opening the link installs a malicious file on the phone, connecting it to a remote computer and allowing a hacker to continue exploiting the device.

Wahle used Metasploit penetration testing software to highlight the vulnerability and is set to demonstrate the attack at this year's Hack Miami conference in May.

BioHacker should be hitting a theatre near you in an alternate-reality version of 1995. **Stephen Lambrechts**

A Windows into Sydney

Microsoft announces its first intercontinental store is opening down under.

Despite the fact that Sydney is above-average when it comes to technological uptake, its small population — in the broad scheme of things — perhaps makes it a curious destination for Microsoft to open its first official store abroad. Several Microsoft Stores are already open in the US, with the company citing timing and opportunity as the driving factors behind its selection of a 6,000 square meter space in Sydney's popular, Pitt Street Mall shopping area. Sydneysiders can expect to take any device running a Windows OS into the store for troubleshooting by the end of 2015. **JB**

Windows 10 to launch as soon as July?

The Microsoft cat escapes from AMD's bag.

In a public address on the company's earnings in April, AMD's CEO Lisa Su accidentally let slip one fact that its partner Microsoft was probably hoping to keep under wraps: the date its highly anticipated Windows 10 OS will launch. Though it's possible the president of the CPU and GPU manufacturer may have been using the phrase 'late July' as a placeholder for the launch date of Windows 10, the intimate business relationship between the two companies suggests it's likely that AMD is privy to this information, and that Su simply made an honest mistake when answering an investor's question. **JB**

ESA opposes revival of old videogames

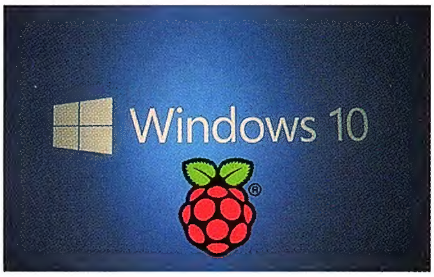
Organisation claims restoring abandoned games is 'hacking'.

As we reported in *APC* 414, back in February a Harvard Law student lodged an amendment proposal to US's Digital Millennium Copyright Act, aimed at protecting game preservationists from copyright persecution if they disabled DRM in order to keep abandoned games alive. Perhaps unsurprisingly, the Entertainment Software Association — which represents the interests of large videogame publishers — has made it plain that it intends to oppose the amendments, citing that permitting the changes would destroy the game industry and that reviving abandoned games was nothing more than hacking. **JB**

360°

THE NUMBER OF DEGREES THAT FUTURE GOPRO CAMERAS WILL CAPTURE.

In April, GoPro acquired a French camera-solutions company that specialises in VR and 'spherical media solutions'. Kolor not only produces a series of camera rigs designed to mount up to six GoPros (both the standard and waterproof cameras), but also creates the software to stitch together those camera's feeds into three-dimensional footage. The GoPro promotional video showing off the tech, called "Land, Air and Sea", will be available on the Oculus Rift and Samsung Gear VR soon, potentially paving the way for a strong future for the adventure-camera company in VR content production.



10^9

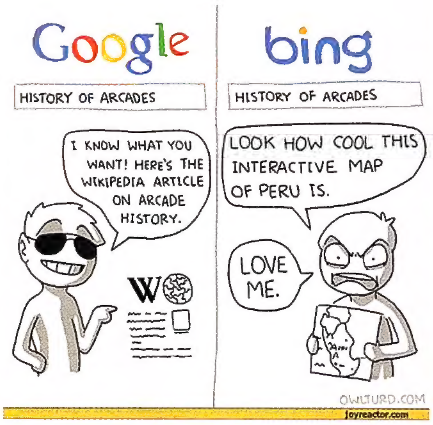
THE NUMBER OF DEVICES RUNNING WINDOWS 10 BY 2018?

The release of Microsoft's next OS is intended to span 190 countries in 111 different languages — and the software giant is so keen to get the OS out there that they are providing free upgrades to Windows 10 for anyone that already has Windows 7 or 8, whether the copy is legitimate or pirated. (Although pirates will still have to pay for the OS, eventually.) It hopes to have 1 billion devices running the new OS by 2018. Considering the software giant's recent moves to make Windows 10 available on not just PCs and phones, but other platforms like the Raspberry Pi and Arduino, the Redmond company may have the breadth to pull it off.

20%

BING'S SEARCH-ENGINE MARKET SHARE.

In a recent dissection of web search engine usage, analytics company comScore reported that Microsoft's Bing — often the butt of jokes for its perceived low market share — was doing surprisingly well, accounting for around 20% of all searches across the US. That said, there does seem to be something of an art to calculating those numbers, with rival analytics organisation statCounter reporting that Bing's reach in the US is closer to 12%.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THE WEIGHT OF TWITTER'S DEBT IN ONE DOLLAR BILLS

Twitter doesn't have the best track record when it comes to financials. Not only did it fumble the release-date of its quarterly earnings report — a small financial firm's URL-searching-bot found it online an hour before it was officially released — but in that report Twitter also announced a US$162 million operating loss in the first quarter of 2015. Ironically, the small financial firm that discovered the report used Twitter to release the non-leaked, non-hacked document, which brings the social-media company's total debt to a staggering US$1.5 billion. Given a US dollar bill weighs roughly one gram, Twitter owes a heavy sum — however you want to calculate it.

X2

APPLE BECOMES THE HIGHEST-VALUED COMPANY IN THE WORLD, BY A WHOPPING FACTOR OF TWO.

ExxonMobil is an American multinational oil and gas corporation that has 31 refineries in 21 countries, over 75,000 employees and is the second-largest publicly listed company in the world, but the current market believes that Apple is worth twice as much. Posting a 27% increase in first-quarter revenues, Apple turned over US$58 billion, pocketing $10.2 billion of this. 69% of this revenue is found offshore, with China overtaking the US in iPhone device sales and, for the first time, surpassing Europe for overall revenue generated.

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» GEAR WE WANT

NES30 PRO BLUETOOTH CONTROLLER

PRICE: TBA | 8BITDO.COM/NES30PRO

Following on from peripheral maker 8BitDo's previous NES-style Bluetooth controller, the well-received NES30, comes its next evolution – the NES30 Pro. Now featuring twin analog sticks, and a more rounded design reminiscent of the SNES or Wii Classic controllers, the NES30 Pro looks like the ideal pad for retro gamers everywhere. The NES30 Pro has a smart built-in ARM Cortex-M3 32 CPU for minimising lag as well as emulating Wii, RetroN5 controllers. It will work on Windows, Mac OS X, Android (100% support) and iOS iCade games. You can also use it to play EMU emulator games. Game on. **Stephen Lambrechts**

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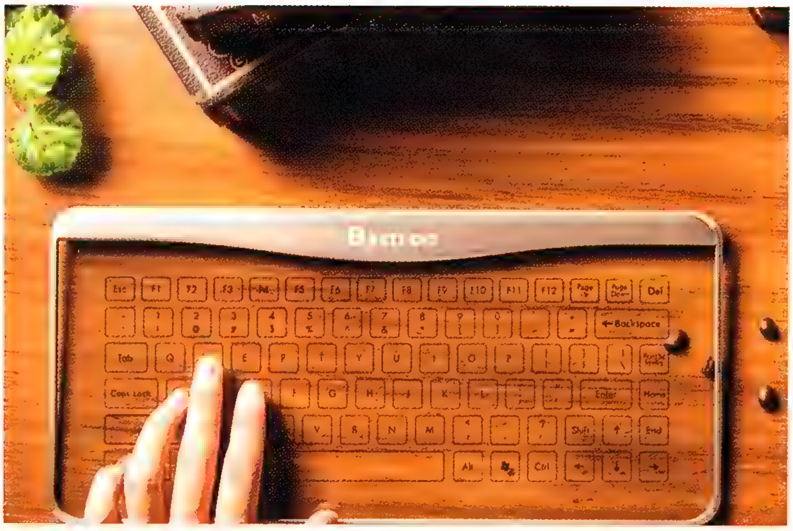
START



BASTRON GLASS TOUCH SMART KEYBOARD

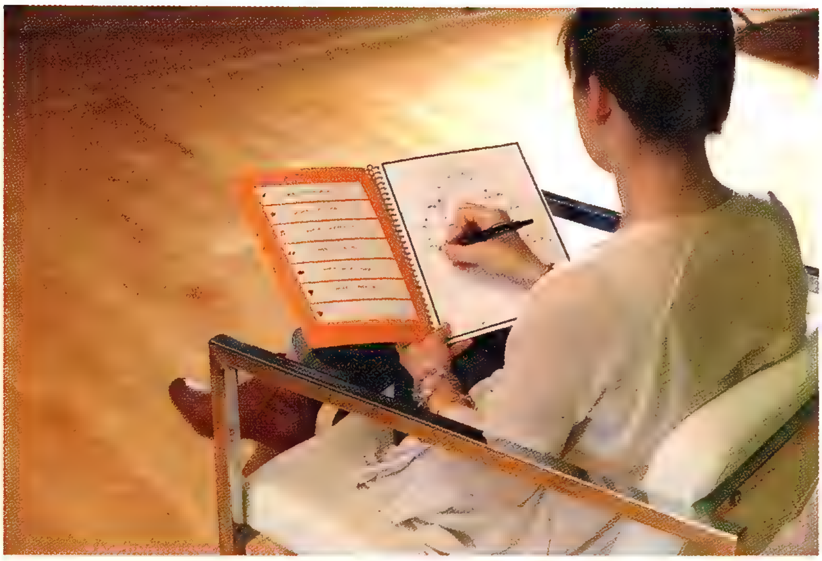
US$199 | BASTRON.COM.CN

We haven't had the opportunity to actually give this a whirl, so we can't give any advice on how it performs, but if looks are anything to go by then this see-through keyboard from Bastron could be special. Blending neatly into your tabletop or lighting up like a spaceship in the dark, this micro-USB connected device is – if nothing else – original. More than just a pretty face, the Bastron keyboard can also simultaneously function as a mouse with over 14 recognised gestures. If you're looking for precision typing this touch-based board probably isn't your best bet, but if you want your place to look like a scene from *Minority Report*, then you'll struggle to find anything slicker. **Joel Burgess**

RECON INSTRUMENTS JET

US$699 | WWW.RECONINSTRUMENTS.COM

Google Glass is in wearable limbo, but that doesn't mean there's no place for augmented reality glasses. The Recon Jet is a pair of sports sunglasses with a display for viewing your speed, times and maps, and a camera for taking video. The unit is actually removable from the sunglasses, so you can just pop it on when you want to use it, and its built-in GPS and motion tracking mean you can leave your phone at home. It's great for cycling, running and lots more.



ROCKETBOOK

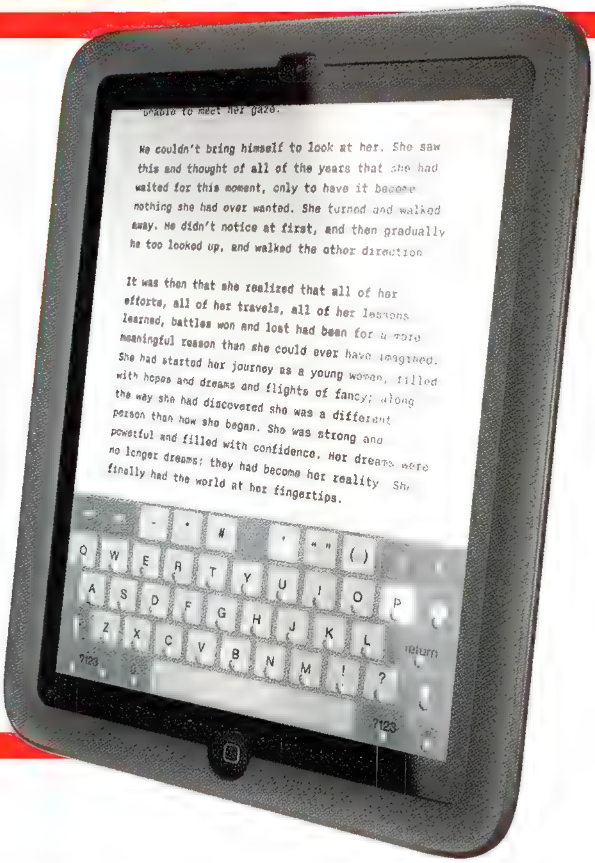
US$25 | TINYURL.COM/APC416-ROCKB

"My mum microwaved my homework!" just doesn't have the same authenticity as the old excuse involving the dog, although thanks to this new product, it's now at least feasible. The Rocketbook's underpinning tech isn't what we'd call groundbreaking: you write in a pad and then upload your scribblings to various note-taking services using a scanning app on your smartphone. As the name may suggest, Rocketbook does pitch itself as the most efficient at uploading scans however, so on the proviso it's accurate (and fast) that might not be so bad. But the Rocketbook's most-interesting unique feature is that, once all your notes are saved, you can wipe the whole book by tossing it in the microwave and giving it a quick blast. **Joel Burgess**

PHORM

US$99.99 | TACTUSTECHNOLOGY.COM

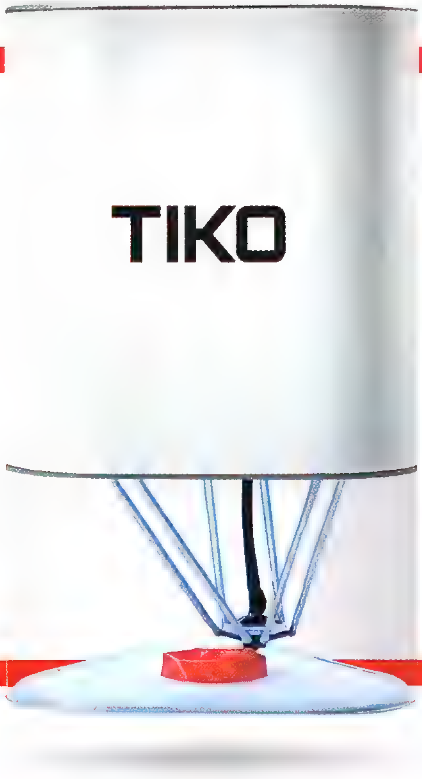
What is it? Slide the built-in button on the back of the case and a tactile keyboard emerges right there in front of you on the screen – raised bumps to guide your fingers to the correct keys. This lets you type in a much more natural way, pounding out your next masterpiece of prose by touch, rather than having to stare pointedly at your iPad's graphical keyboard. When's it due? Pre-order now, Australian release date TBC. Why are we excited? Seeing those little bumps pop up out of nowhere is almost magical. It's a simple idea, but one with an awesome mystique. It's available for the iPad mini, with an iPhone 6 Plus version in the works. Vote for devices the Phorm should be developed for on its web site.



unable to meet her gaze.

He couldn't bring himself to look at her. She saw this and thought of all of the years that she had waited for this moment, only to have it become nothing she had ever wanted. She turned and walked away. He didn't notice at first, and then gradually he too looked up, and walked the other direction

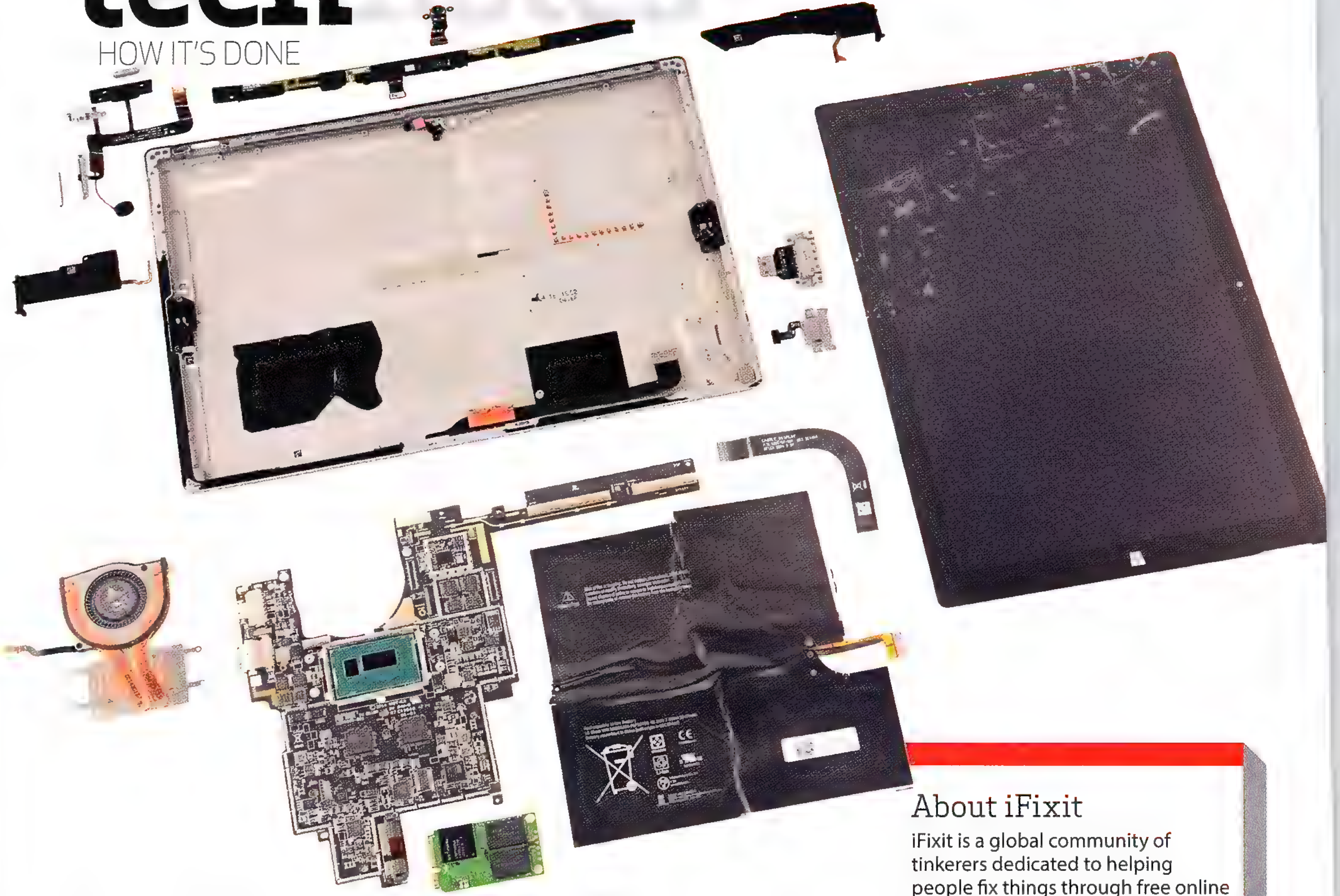
It was then that she realized that all of her efforts, all of her travels, all of her lessons learned, battles won and lost had been for a more meaningful reason than she could ever have imagined. She had started her journey as a young woman, filled with hopes and dreams and flights of fancy; along the way she had discovered she was a different person than how she began. She was strong and powerful and filled with confidence. Her dreams were no longer dreams; they had become her reality. She finally had the world at her fingertips.



TIKO

US$179 | WWW.TIKO3D.COM

People often say that 3D printers need a company to make them Apple-like – when they really mean "to make them pretty." But if Apple made one, we'd see a whole different design, with its own unique benefits. That's what Tiko has done. A unibody enclosure adds strength cheaply, its triangular printing configuration is precise yet inexpensive. It offers detailed printing of fairly large objects, despite having a small footprint. It's safe, it's wireless, and it's one of the best we've seen. It should be out later this year.



Surface Pro 3

Its beauty isn't just skin deep — or is it?

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit **www.ifixit.com**.

It's not entirely clear if what holds the ultra-thin hybrid's innards together is black magic, or just another black substance at work.

MAJOR TECH SPECS

- Core i5, 128GB SSD, 4GB RAM model; other options available
- 12-inch ClearType Full HD Plus IPS LCD with a resolution of 2,160 x 1,440 pixels
- Fourth-generation Intel Core i5 Haswell chip
- Marvell 88W8897 WLAN (802.11ac/802.11 a/b/g/n) plus Bluetooth 4.0
- SK Hynix HFS128G3AMNB 128GB mSATA 6Gb/s SSD
- Samsung K4E8E304ED-EGCE LPDDR3 RAM
- 5.0 MP/1080p front- and rear-facing cameras
- Full-size USB 3.0 port, microSD card reader, and Mini DisplayPort
- Dolby speakers
- 42.2W, 7.6V, lithium-ion battery

KEY FINDINGS

- Even taking extra care when heating and prying up the screen's glass wasn't gentle enough: The cooling adhesive alone was enough to crack the display's surface on our photo table.
- Hugging the back of the display is an N-trig DS-P4196 touch controller.
- Microsoft has added a 150-degree angle option to the kickstand, allowing the Surface Pro 3 to lay nearly flat.
- The status LED and microphone live right next to the rear-facing camera.
- Something new: a springy metal bracket pinning the display connector in place.
- Sticky, gooey adhesive is everywhere.
- The cooling system is more akin to one found in a laptop than a tablet, and uses one-half the fannage of its predecessors.
- Beneath the heatsink we find the CPU, but it's not coming off the board.
- Repairability Score: 1 out of 10 (10 is easiest to repair).
- So much is crammed into so little space, resulting in a high potential for damage during every major step of disassembly, even with some parts being replaceable. The SSD can be replaced, but not without first risking damage to the tablet simply by opening it. The battery is not soldered to the motherboard, but very strong adhesive makes removal and replacement a hazardous chore. Added to that is the incredible difficulty in removing the display, with its non-standard connectors, a fused glass panel/LCD that's incredibly tricky to remove and replace, and an insanely delicate opening procedure that has no wiggle room for mistakes. Any DIY fixes become a dicey proposition. ■

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BLACKBOOK
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technotes

» EPINIONS

What's the definition of free software? It's not just open source...!

PEDANTIC SEMANTICS CORRECTED

I'm sorry Ian Hollis (Epinions, *APC* May, page 15), but you are so wrong. An item that is "free" whether it be hardware, software or even a service means just that: it is free from any form of purchase cost. What you seem to be describing is "open source software" of which Microsoft Windows is definitely not, in any shape or form. Also, you must not have read any press releases regarding the release of Windows 10 as they state quite clearly that the free upgrade will have a window of availability of 12 months for Windows 7 and 8 users. After that time you will have to purchase the software. Nowhere was anything mentioned that an annual licence fee would be charged. The software will be fully functioning and perpetual with the only limitations of support after the "sunset" period (which is the same for all Microsoft software).

Obviously, after the debacle of Windows 8, Microsoft wants to get as many end users onto Windows 10 as quickly as possible and what better way than to provide it free of charge for a limited time. Microsoft may have finally got it right!

Mick Gillies

"Nowhere was anything mentioned that an annual licence fee would be charged."

NOT SO SAFE

Recently on 774 ABC radio Melbourne, a caller asked their "geek expert" about a phishing scam that's been masquerading as a WhatsApp message. The expert's advice was, "As I tell everyone, just get a Mac." That kind of condescending ignorance really gets up my nose. I'd already received this scam from a friend. I rang her to explain that she'd handed over her email password and that she needed to change it immediately if she could. She said, "I didn't think this could happen to me on a Mac?" Apple is a great marketing company with incredible brand loyalty, but its customers are not immune from user stupidity. Apple's "no viruses" assumption appears to prevent a lot of users – even expert ones – from thinking about what they're doing on the big bad internet. That's gunna cost.

Stuart

BACKUP VOLUMES

Your March issue has an excellent article on encryption on page 84 and I want to try it. The article unfortunately fails to point out if SyncBack will backup the encrypted volumes too? It would be most helpful if you could disclose this information?

Gunther Jank

Ed replies: *Glad you liked the article! Regarding encrypted backups, it should be fine to back up the .sdsk files that SafeHouse Explorer creates with SyncBack (or any other backup program, for that matter), but you'll need to make sure the .sdsk's encrypted 'volume' isn't open and/or in use at the time. If it is open, SyncBack may not be able to read the .sdsk correctly.* ■

APCMAG@FUTURENET.COM

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Hollywood vs VPNs

A war is brewing in Tinseltown against VPN services. Stephen Lambrechts

We're big supporters of VPN services around these parts, which is why we're not too happy to hear how much Hollywood detests them and wants them out of the picture.

Thanks to VPNs, Australians had been accessing services like the US version of Netflix for years before it legitimately arrived on our shores. And while the local version of Netflix is easily our best streaming service to date, the Aussie content library is paltry compared to the US – despite costing customers the same amount. People are still paying for the content, and the studios still get a cut, but the money isn't coming from the right territory.

Still, movie studios and distribution companies are hitting back harder than ever, trying to get ISPs and streaming services to ban users from accessing content via VPN services. Leaked emails from the recent Sony Pictures hack have brought to light instances where the studio had put pressure on Netflix – suggestions were made to make it harder for overseas users to access the service by restricting certain payment methods. Sony Pictures' president of distribution, Keith Le Goy, stated that "this is in effect another form of piracy – one semi-sanctioned by Netflix, since they are getting paid by subscribers in territories where Netflix does not have the rights to sell our content." TV companies in New Zealand have also started putting the screws to ISPs that provide VPN services, going as far as threatening to sue them.

Now, a bill has been submitted in the Australian Parliament proposing to ban certain VPN services outright, with the stated aim of stopping online copyright infringement. According to the authors, the bill's function is "to block access to an online location that has the primary purpose of infringing copyright or facilitating the infringement of copyright." The bill also states that "copyright owners would be able to apply directly to the Federal Court for an injunction to disable access to an infringing online location."

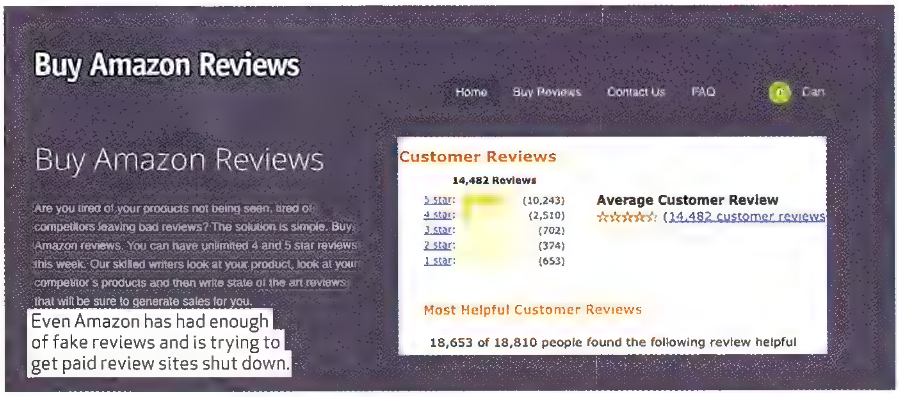
While we can understand that Hollywood spends large amounts of money on content licensing deals, a lot of the time those deals aren't in the best interests of the consumer – and are potentially even anti-competitive.

We live in a digital age, where downloading is simple, so it's puzzling as to why these kinds of deals are still being made. In Australia, they often seem designed to make customers wait an eternity, or force us into purchasing expensive cable packages we don't want in order to see the shows or films that people overseas take for granted.

Of course, we also live in an age where technology is always one step ahead of the establishment, so whether or not governments and corporations have the capability to put a stop to VPN services is another matter entirely... ■

Follow up: Amazon files lawsuit over fake reviews on its site

It's often hard to know if a review you're reading on Amazon is legitimate or not, which is why web sites like Fakespot (**fakespot.com**) have become invaluable for cutting through the crap. Amazon itself has apparently finally had enough of fake reviews, filing a lawsuit against four companies for selling bogus write-ups to the site's merchants. **BuyAmazonReviews.com, BuyAzonReviews.com, BuyReviews.net** and **BuyReviewsNow.com** were all listed in the filing made by the world's largest online store, accusing them of false advertising, trademark infringement, and violation of anti-cybersquatting laws. Mark Collins, owner of BuyAmazonReviews states that the company only sells "honest and unbiased" reviews.



Buy Amazon Reviews

Are you tired of your products not being seen, tired of competitors leaving bad reviews? The solution is simple. Buy Amazon reviews. You can have unlimited 4 and 5 star reviews this week. Our skilled writers look at your product, look at your competitor's products and then write state of the art reviews that will be sure to generate sales for you.

Customer Reviews

14,482 Reviews

5 star:	(10,243)
4 star:	(2,510)
3 star:	(702)
2 star:	(374)
1 star:	(653)

Average Customer Review
☆☆☆☆☆ (14,482 customer reviews

Most Helpful Customer Reviews

18,653 of 18,810 people found the following review helpful

Even Amazon has had enough of fake reviews and is trying to get paid review sites shut down.

ENDUSER

Share your stories!

If you have an iteresting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

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HOT PRODUCT

TABLET

FROM $699; TYPE KEYBOARD, $180; STYLUS, $60 | WWW.MICROSOFTSTORE.COM

LABS BENCHMARK RESULTS

General system performance

PCMARK 8	HOME (SCORE)
MICROSOFT SURFACE 3	1670

X264 HD BENCHMARK 5.01	AVG FPS - PASS 1
MICROSOFT SURFACE 3	12.69

X264 HD BENCHMARK 5.01	AVG FPS - PASS 2
MICROSOFT SURFACE 3	3.54

Gaming performance

3DMARK	ICE STORM UNLIMITED (SCORE)
MICROSOFT SURFACE 3	24,823

Battery life

PCMARK 8 HOME	HOURS:MINS
MICROSOFT SURFACE 3	5:14

PEACEKEEPER	WEB SURFING (HOURS:MINS)
MICROSOFT SURFACE 3	6:27

Microsoft Surface 3

Third time's the charm for Microsoft's budget Surface tablet.

Interest in tablet PCs has been on the wane, with even bigwigs like Apple hit: it now makes more money from its Macs than it does iPads. So it's perhaps not the best time for Microsoft to be launching its third price-conscious Surface tablet, and the official successor to the Surface RT and Surface 2. If any tablet is going to buck that downward trend, however, the Surface 3 might just be the one to do it, thanks largely to its more flexible and productivity-focused design.

The 12.2-inch Surface Pro 3, launched in mid 2014, was a great improvement on what came before. It more clearly solidified Microsoft's view of the Surface as a device as much for work as for play, and this new less-costly version brings the best improvements from the Surface Pro 3 down to a less wallet-busting price. That includes the full version of Windows 8.1, a friendly 3:2 aspect-ratio screen, multi-angle kickstand and (optional) improved Type keyboard. Also along for the ride are the Pro 3's front-facing stereo speakers, full-sized USB 3.0 socket and a mini-DisplayPort output.

It also shaves a fair bit of the size and weight off too, packing a slightly smaller 10.8-inch, 1,920 x 1,080-pixel display and weighing in at 622g (sans keyboard or stylus) and 8.7mm thick. That's still not iPad or Android-tablet class, but its a big step down from the Pro 3's heftier 798g at 9.1mm. And inside is Intel's new Cherry Trail Atom processor (the x7-Z8700) — a true quad-core chip that keeps Windows 8.1 running smoothly and responsively (provided you don't run more than a couple of moderately-demanding apps at once).

The further-tweaked Type keyboard also bears a mention; it's now got a proper, glass-topped trackpad with a physical click mechanism, plus very-slightly more travel in the keys. It's still an optional extra though, as is the stylus. For us, both are basically essential, with the stylus a must to use Windows' industry-leading handwriting recognition. (Seriously, if you want to input text into a tablet this way, Microsoft is lightyears ahead of the competition.)

In laptop mode, one problem we've always had with Surfaces is that the kickstand doesn't actually work too well on your lap; its precarious to balance. This new model lets you extend that kickstand quite wide, so its easier to balance... if your lap is long enough, that is.

The new 3:2 display is great, however. As on the Pro, this aspect-ratio makes it excellent for working with office documents and surfing the web.

Some bugbears do still exist. For example, of the 64GB of storage on the entry-level model, with Windows, the recovery partition and Office 365, you end up with about 35GB left. That extends to a healthier 85GB on the 128GB model, at the cost of an extra $140. That storage can also be expanded by throwing a microSD card (up to 128GB) into the slot located under the kickstand, but that won't be as fast as the onboard solid-state drive.

Starting at $699 RRP is fairly reasonable given the capabilities on offer and it also includes a year's subscription to Office 365. What makes things a bit trickier, is that to really use the Surface 3 to its full capabilities you'll need to spend another $240 to add a Type Keyboard and a stylus. Microsoft has done a great job here, with the premium build-quality matching up to that premium price. It's one of the best hybrids yet, but it could still benefit from further advances in mobile PC tech. ■ **Dan Gardiner**

Verdict

Features	★★★★½
Performance	★★★★
Value	★★★★

The best budget Surface yet, with the full Windows 8.1, light weight and respectable performance.

★★★★½

✓✓✓
apc
RECOMMENDS

MINI PC

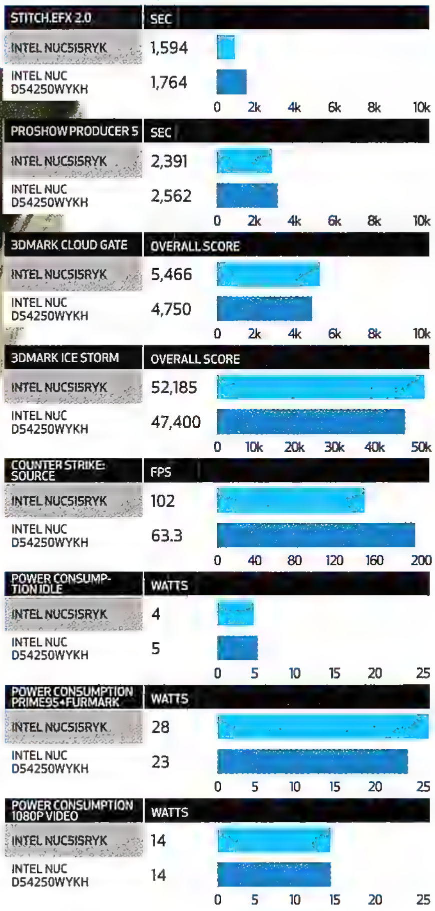
$529 | WWW.INTEL.COM

Intel NUC5i5RYK

Need ultrabook components in a tiny desktop?

LABS | BENCHMARK RESULTS

Performance comparison



Intel's quasi-barebones NUC PC is back for round three, with this snappily named 'NUC5i5RYK' SKU leading the charge. Equipped with Intel's i5-5250U dual-core CPU, clocked at 1.6GHz, the processor still comes soldered to the NUC's motherboard. And again, owners will have to bring their own OS to the party.

As well as that new Broadwell CPU, there are several upgrades to the NUC5i5RYK. It now supports 16GB of 1,866MHz SO-DIMM RAM,up from last-gen's 1,600MHz. This NUC also does away with both SATA and mSATA slots and replaces them with the faster M.2 standard. Our test sample came with its own Intel 530 series M.2 SSD and Samsung's more expensive XP941 series 256GB drive. One last bonus is an 802.11ac and Bluetooth 4.0 combo adapter.

Considering Broadwell is a 'tick' on Intel's tick-tock roadmap and equates to a new 14nm manufacturing process, the new CPU is focused more on power efficiency than pure performance gains. Oddly enough, however, we saw a bit of the reverse in our tests. This NUC5i5RYK soaked up roughly one watt less at idle than the D54250WYKH Haswell NUC we reviewed last year, but consumed roughly five more watts when under load.

Thankfully, this Broadwell NUC made up for it in performance, where it bested its Haswell cousin by roughly 7 to 10% in CPU benchmarks.

We saw an even bigger increase in GPU speed. The NUC5i5RYK uses Intel's HD Graphics 6000, and while it doesn't hold a candle to Intel's Iris Pro graphics, it's a big step up from last gen's 5000 series, beating it by 10 to 45% in our tests.

Considering the box is quite small, you might wonder how hot or loud it gets. When it's sitting idle, it's both cool and quiet. Under the onslaught of our benchmarks, however, the fan did rev up, but it was hardly offensive. It also got a little warm to the touch.

The real story here pertains to the included M.2 slot, which allows for some ridiculous storage speeds. With Intel's 530 Series M.2 SSD, we saw sequential-read and -write speeds of 419MB/s and 213.6MB/s, respectively, using CrystalDiskMark. Those numbers aren't super impressive, but considering a 180GB drive will cost you $175, it isn't a super high-end SSD either. When we plopped in Samsung's more expensive ($370) XP941 256GB M.2 drive, however, we got speeds of 1,089MB/s and 798MB/s, respectively. Your gran's traditional 2.5-inch SSDs can't touch those numbers, as they're limited to SATA III's 6Gbps bandwidth cap. The downside of M.2 SSDs at the moment is that they aren't as plentiful as traditional 2.5-inch SSDs, meaning you pay a premium for them.

If you can stomach the extra cash the M.2 slot currently demands, you'll appreciate some of the tweaks this NUC brings to the table. The included Bluetooth and Wi-Fi are great, and we like that you can stuff speedier RAM in the box. It's certainly not hard to build into either, and could be a good first step for the new PC builder. That said, you have to purchase your own storage, RAM, and OS, plus install all the drivers yourself, which may turn off PC noobs from picking up what is essentially a pretty cool ultrabook tossed into a very small desktop form factor.

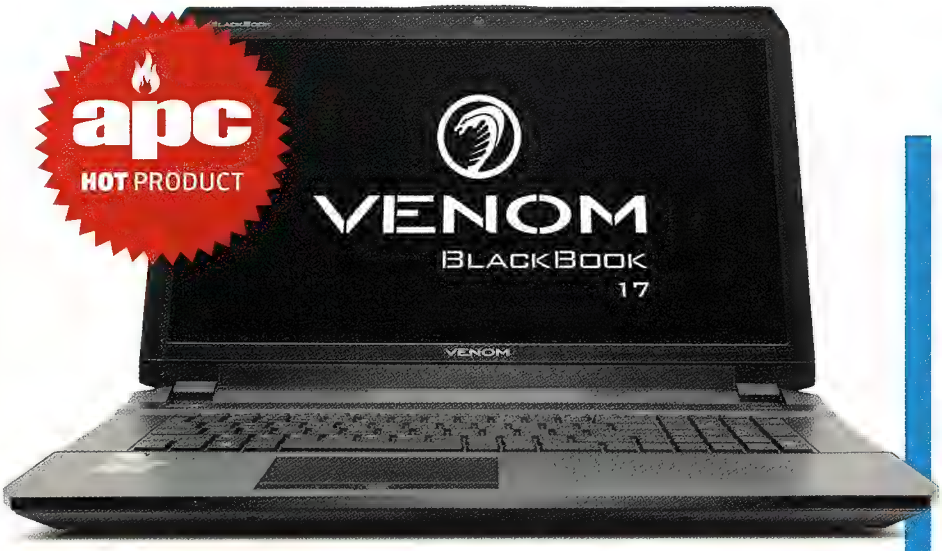
■ **Jimmy Thang**

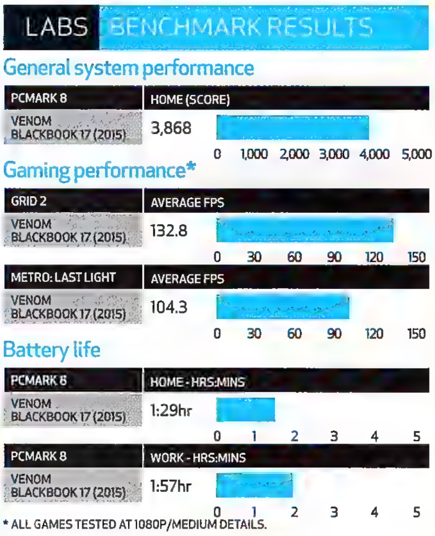
Verdict

Features	★★★★
Performance	★★★★
Value	★★★★

Wi-Fi and Bluetooth wireless combo is nice; M.2 slot opens up speedy storage opportunities; supports 1,866MHz RAM.

★★★★





* ALL GAMES TESTED AT 1080P/MEDIUM DETAILS.

PERFORMANCE LAPTOP

$3,899 | WWW.VENOMCOMPUTERS.COM.AU

Venom BlackBook 17 (2015)

What's big, black and categorically doesn't compromise? This high-performance laptop.

Any way you measure it, Venom's 17-inch BlackBook is a bit of a monster. If you want a no-compromise, high-performance laptop that will chew up anything you throw at it, this one should be high on your list. Just don't plan on taking it too many places; at 3.36kg (plus 850g for the charger) this is one that will send you hobbling straight to the chiro if you try commuting with it every day.

While it's undeniably a huge laptop, it still manages to chuck some style into the mix, and with some of its 17-inch competitors pushing 4kg, it's perhaps not quite the behemoth it could have been. The dark black, brushed-metal finish on the lid and the angled edges do have a slightly slimming effect and this is, overall, a rather discrete machine, but one that hides a lot of power. That means a quad-core Core i7 processor combined with a GeForce GTX 980M graphics chip, plus a blazing-fast Samsung XP941 M.2 SSD and 16GB of low-latency memory. There's a secondary 1TB Hitachi hard drive for more general storage, and basically a full-sized keyboard with a big friendly trackpad containing a fingerprint reader.

Having a good screen is important for any laptop, but that's especially the case with a screen this big. Although it's only 1080p resolution, that still provides plenty of detail and, what's more, it doesn't throw up any of the Windows interface scaling problems that higher-res displays can cause. Better yet, its got deep natural colours and excellent contrast, so even in dark, moody movies and games you can see a pleasing amount of shadow detail.

What you won't find are the 'frills' included with some other gaming laptops: the keyboard backlight only comes in white, there's no Killer networking card and it doesn't have flames painted up the sides. Ultimately, that doesn't effect performance, and the BlackBook 17 has that in spades. What's great isn't just the hardware though: Venom's helpfully preinstalled useful applications in Windows – like Firefox, Chrome and a handful of benchmarks – and a full year's subscription to Norton Internet Security.

It's not just games that run well on this hardware either: the OS as a whole is zippy, even when you're doing mundane tasks.

It's also worth pointing out that, while this BlackBook may not be as sleek as the Gigabyte (page 22), it arguably has a more responsible design. Its CPU and GPU top out at much healthier temps and it doesn't sound like a leaf-blower when doing so. Like any gaming laptop, there is fan noise, but it's not too high-pitched and doesn't rev up and down all them time. Ultimately, that should result in not just longer life for the CPU and GPU, but all the surrounding components (which will suffer under prolonged exposure to high temperatures) as well.

The trade off for all the power under the BlackBook's hood is that battery life is very ordinary: in our tests, it lasted around 2 hours for web surfing and just 1.5 hours for more-demanding, mixed-use multitasking. Top-shelf tech doesn't come cheap either, so if you want this kind of performance in a portable package, you'll need to accept the fact that it comes with a fairly monstrous – if largely justifiable – price tag.

■ Dan Gardiner

Verdict

Features	★★★★½
Performance	★★★★★
Value	★★★★

Yes, the price is eye-watering, but the BlackBook 17 packs the specs and performance to back it up.

★★★★½

GAINWARD

NVIDIA
GEFORCE
GTX

GAINWARD
PHANTOM

Extreme Silent

Extreme Cool

PHANTOM
GEFORCE GTX 960

GOLDEN SAMPLE GLH GOES LIKE HELL

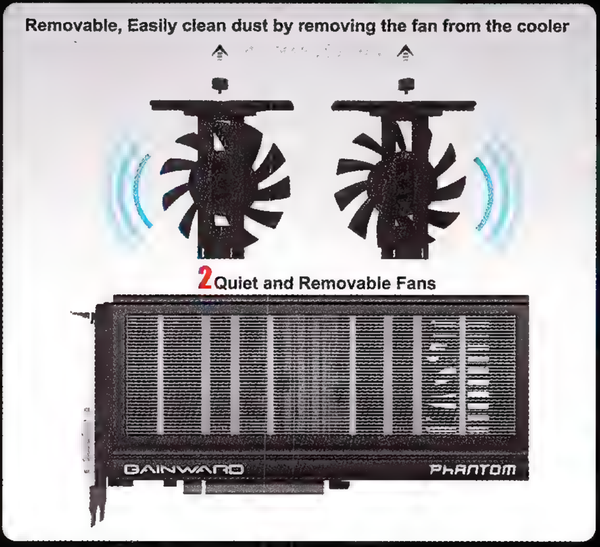
15 % up
PERFORMANCE UPGRADE

New Phantom cooler design

Gainward GTX 960 Phantom, continue the elegant design of the first generation. The new Phantom comes with brand new fans design (Patent M456684/ZL201320139962.6) that includes

1) Removable fan design - each fan body can be removed to clean if necessary
2) 4 pieces of copper heat-pipe and copper base - better thermal performance
3) solid structure

With this new outstanding innovated thermal design and optimized product design Gainward GTX 960 Phantom delivers an extreme gaming performance for enthusiast gamers.


Removable, Easily clean dust by removing the fan from the cooler
2 Quiet and Removable Fans
GAINWARD
PHANTOM

GIGABYTE
apc
RECOMMENDS

GAMING LAPTOP

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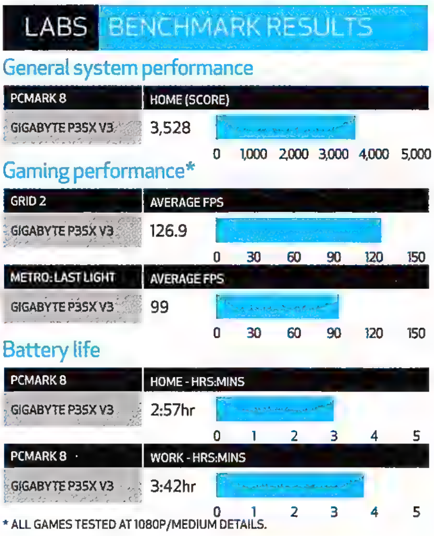


* ALL GAMES TESTED AT 1080P/MEDIUM DETAILS.

Gigabyte P35X v3

'Big but slim' is the theme of Gigabyte's latest gaming laptop.

The quest for the thin and light (well, light-ish) gaming laptop has been one that PC makers have been pursuing for years now, with varying results. In general, with each new generation our portable-PC tech has become both more power-efficient and cooler – alongside getting faster, of course. Unfortunately, we're not quite at the point where you can have an ultrabook body with top-drawer gaming prowess. Every performance laptop is always a trade off to some degree – a balancing act between price, performance and build quality.

This new 15.6-inch gaming machine from Gigabyte is a good example. It follows the company's general trend towards making sleek, slim machines that still pack the latest and greatest kit under the hood. At just 2.1cm thick, the P35X v3 still manages to wedge in a quad-core Core i7-4710HQ processor, 16GB or memory, GeForce GTX 980M graphics chip and a 256GB RAID drive for the OS (using two 128GB SSDs) and a 1TB hard drive for storage. And all for a relatively affordable $3,100 on the street.

As you'd expect, those components turn up good benchmark results – this one flies along whether you're gaming, encoding media or just casually surfing the web. And it delivers surprisingly good battery life too – managing between 3-4 hours in our intensive PCMark 8 Home and Work battery tests.

It's reasonably well-appointed in terms of usability too – the keyboard's near full size and has good travel on the keys, while the matte-finish trackpad is large and responsive. The screen on our test unit was a 2,880 x 1,620-pixel (aka 3K) number, but locally you'll find it's 1080p – it's therefore hard for us to pass final judgement, but on the 3K version the viewing angles were good and colours deep (although not neutral, a little warm). The screen bezel was a little thicker than we'd have liked, however, especially on the top and bottom.

In terms of external build quality, the P35X v3's lid and the keyboard deck are aluminium alloy, although the bezel around the screen and the unit's whole underside are plastic. Weighing in at 2.5kg (plus 640g for the charger) it's not super portable, but can be lugged if necessary.

If the P35Xv3 has a main shortcoming, its in the noise and heat it generates while gaming. Like the P34W v3 we reviewed back in *APC* March, page 29, this bigger model does get loud when gaming, with quiet rear-facing exhaust fans used to vent the hot air generated by the CPU and GPU when under load. As those fans are smaller in size than those in the BlackBook (see page 20) for example, they need to spin faster to move the same amount of air – and they generate a higher-pitch whooshing sound as a result. That slimmer design also means that overall cooling isn't as efficient as in a fatter laptop either. That's apparent in the CPU and GPU temperatures, which reach a toasty 92°C and 87°C (respectively) – a lot higher than the 74°C and 72°C of the BlackBook.

The P35X v3 is, overall, quite good value for the specs on offer, and its thin design is quite physically pleasing. But while it might be physically discrete for a gaming laptop, acoustically it leaves little doubt.

■ **Dan Gardiner**

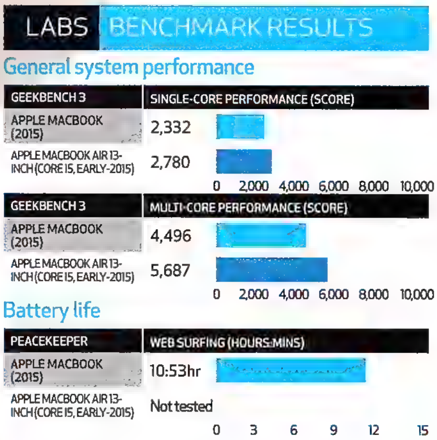
Verdict

Features	★★★½
Performance	★★★★
Value	★★★★½

Great specs at a reasonable price, but heat and noise are perhaps the true cost.

★★★★½

apc
RECOMMENDS



LAPTOP

FROM $1,799 | WWW.APPLE.COM/AU

Apple MacBook (2015)

Forget 'thinking different' — this little laptop thinks big instead.

The 12-inch MacBook is Apple's most radical laptop design since the debut of the Air back in 2008. This is a mini laptop at a premium price, with a heap of new design tweaks that give you outstanding features in a very small package. Apple's made some contentious decisions here, however. It's ditched basically all the traditional ports in the name of that wafer-thin design, with just two physical inputs — one USB Type-C port for power/data connectivity, plus one 3.5mm audio in/out socket.

That USB Type-C port is the controversial bit: it's so new that you'll struggle to find anything else using it. And Apple doesn't give you anything in the box to help with backwards compatibility.

Want to plug in a USB mouse or external hard drive? You'll need to fork out $29 for a legacy USB-port adapter dongle. Want to have a USB peripheral plugged in while you're charging your MacBook? That'll be $119 for a multiport adapter. This is a laptop that's meant to be used like a smartphone or tablet, with all external connections made wirelessly.

If you can live with that idea, you'll find there's a lot to like about the 12-inch MacBook. This is a genuine featherweight, go-anywhere machine, weighing in at 922g and just 1.31cm thick when closed. But thanks to clever design it actually feels bigger than its small size would indicate. With thin bezels around the 2,304 x 1,440-pixel IPS display, a redesigned keyboard with physically larger keys and that big glass trackpad — which itself is a new design with pressure-sensitive Force Touch capabilities — for most tasks, using the 12-inch MacBook feels only slightly less roomy than the 13.3-inch MacBook Air.

It's generally pleasant and responsive too, running on a new Intel 1.1GHz Core M processor (which punches a lot harder than its low clockspeed would imply) coupled with 8GB of RAM and a 256GB SSD for storage. Those new components take up minimal space under the hood, however, with the vast bulk of the MacBook's interior used to house the new terraced lithium-polymer batteries. And those batteries definitely deliver the goods — our web-browsing benchmark lasted an excellent 10:53hr with the display at 50% brightness.

There's only really one place where the MacBook disappointed, and that was in the 480p webcam. Unlike the rest of the top-drawer kit here, its pretty woeful, delivering grainy images and really struggling in low light. And more generally, despite the 8GB of memory Apple has thrown in, the new MacBook doesn't always feel as responsive as we'd like. When loaded with a heap of running apps and browser tabs open, things do slow down: interface animations become jerky (if they play at all) and it takes longer to switch between apps — even the most-basic MacBook Air feels fast and fluid by comparison.

Ultimately, this is a very portable premium laptop — but it's one that's not for everyone. The $1,799 price is largely justified by the cutting-edge features, specs and build-quality on offer. And if you need a compact laptop that provides a bigger experience, there's nothing better out there.

■ Dan Gardiner

Verdict

Features	★★★★★
Performance	★★★★☆
Value	★★★★☆

It's pricey and made for a wireless world, but this is quite possibly the most comfortable compact PC ever made.

★★★★☆

apc RECOMMENDS

CHROMEBOOK

$440 | WWW.ASUS.COM/AU

ASUS Chromebook C300M

A colourful Chromebook that balances price and performance.

Who'd have thought it? The Chromebook is all grown up. Early reviews of these cloud-connected lightweight laptops were a little sniffy, but the Samsung Series 3 in late 2012 silenced much of that criticism. Now a new wave of bigger, better and bolder devices are coming through – still inexpensive, still portable, but with much more power. The ASUS C300M is such a device. With its dual-core Intel N2380 CPU, it has low-end specs for a laptop but more processing power than most other Chromebooks.

With a slim profile boasting a height of 20.3mm from lid to base, the fanless C300M has Ultrabook styling and Chromebook mobility. The 13.3-inch screen is part of a trend towards larger displays.

It still feels like a Chromebook, with a lid barely 5mm thick and a casing that's distinctly springy in places. The build is solid, though, and it looks reassuringly like a standard notebook until you pick it up.

The rounded corners, common to Chromebooks, add a bit of softness to the overall design. It weighs just 1.4kg. That just about enables you to carry it around open in one hand, cup of tea in the other.

As far as ports go, the C300M is better than some Chromebooks, with an HDMI, USB 3.0 and SD Card port down the side. There's also a dual function audio port. The native resolution is 1,366 x 768 and it looks crisp and clear at that, allowing for the relatively shallow viewing angle.

We used the C300M for two weeks in our work machine rotation. It travelled with us, got whipped out on trains and sat in on meetings. The extra width made for a more comfortable typing experience than the Samsung Series 3 Chromebook. The familiar chiclet style keyboard is a functional choice.

Google Apps perform flawlessly, as you'd expect. With just 2GB of RAM on board, Chrome slowed down only with multiple instances of the browser running, each with multiple tabs open.

The real test for a Chromebook is streaming media. Playing Dark Side of the Moon in Spotify Premium, we were able to pick out most of the detail. There wasn't much distortion, but it was thin and focused at the treble end of the spectrum.

Next, we opened Amazon Instant Video for some HD streaming at 720p. The *Doctor Who* special played back stutter-free over our 802.11n Wi-Fi connection – but it's here that the C300M's TN LCD display began to show its weakness. The final outing in the media performance tests was browser based bash-'em-up *Bastion*. At full resolution the C300M handled the cartoony Zelda-alike admirably, with Chrome rarely dropping below 51 frames per second.

ASUS promises a 10-hour battery life and, while we never quite got that in real-world use, it's pretty close. We recorded 9 hours 16 minutes of mixed usage, with power settings tweaked using Keep Awake to prevent the screen from going to sleep. This is outstanding by any measure. We would have preferred to try a version of the C300M with 4GB of RAM to match the 32GB SSD storage, but our overall impression was very favourable indeed.

Though a little larger than Chromebooks of old, this proved to be a mobile machine with much to recommend it. ■ **Karl Hodge**

Verdict

Features	★★★½☆
Performance	★★★★☆
Value	★★★★☆

With battery life that goes on and on, this is a lightweight laptop for people on the move. If they love bright colours.

★★★★☆

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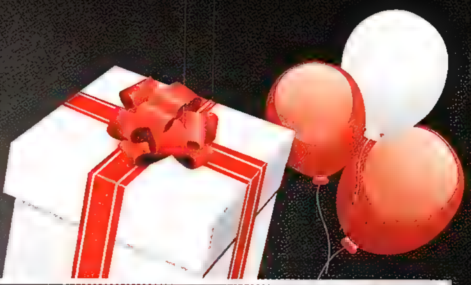

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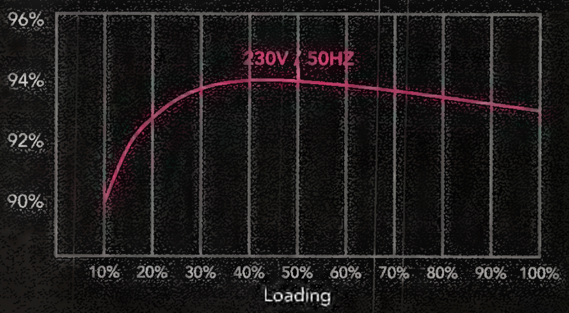

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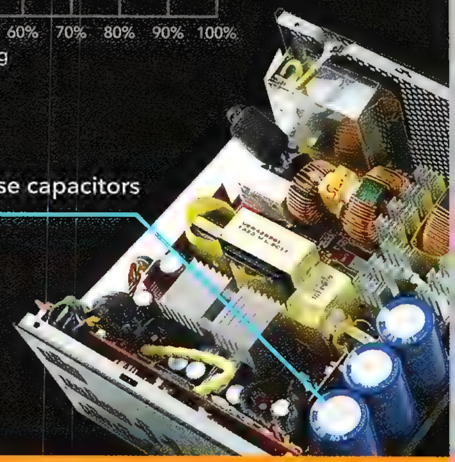

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Philips Brilliance BDM3470UP

Another wondrous widescreen, but this time with a pro bent.

We're broad. We're broad. We're broader than Broadway, sings Philips as it delivers its latest ultra-wide monitor to the *APC* labs. The Brilliance BDM3470UP is a 34-inch slab of AH-IPS panel that adds extra drama and spectacle to any game you care to throw its way. The 21:9 aspect ratio works exceptionally well in-game and, with the 1440p height replacing the 29-inch version's 1080p scale, it's just as good on a standard Windows desktop, too.

It's all about the periphery with these super-mega-ultra-wides and, when you're sat with it close before you on a PC desk, that extra width almost manages to take up the entire span of your view. It's an added level of immersion that we wouldn't necessarily have thought an extra million and a bit more pixels could deliver. Especially given there's over three million more pixels in a 4K display and that still doesn't float our gaming boats.

NO NATIVE NIGGLES

Since we last looked at a non-curved 34-inch display (the AOC U3477pqu – see *APC* Xmas 2014, page 22) the situation regarding support for the previously irregular 3,440 x 1,440 resolution has dramatically improved. With that AOC late last year, we'd had to dip into the Flawless Widescreen application to get things looking beautifully broad. But now it seems developers have almost completely caught up – during our testing this time, we struggled to find a recent title we couldn't get running natively on the Philips.

There will obviously be comparisons with the AOC screen, and not just because these are both 34-inch 21:9 monitors. They are essentially the same monitor. The Philips and AOC screens both come out of the same company, MMD (Multimedia Displays), and if you take the stand away from both monitors and cover up the logos, you'd barely notice any difference. The stand on the Philips is far more elegant than the chunky squared-off frame the AOC attaches to, but they're both fully tilt, swivel and height adjustable.

Where they do differ is in the electronics, controls and calibration out of the box. The AOC looked great at default settings, so we barely needed to spend any time in the basic OSD. The same is largely true for the Philips – the 8-bit LG AH-IPS panel is still beautifully bright and crisp straight from the packaging.

You have a lot more control over the screen with this Philips monitor though, with settings not just for brightness and contrast, but black levels, hue and saturation, too. There are some specific features the U3477pqu has no access to, such as the Pixel Orbiting to cut down on image burn. There's a huge amount of configuration on offer for anyone wishing to get elbow deep. That's great news for those looking to use this mega-wide monitor for video editing, image manipulation or design projects. But that's exactly why this Philips screen is so much more expensive than the almost identical AOC.

If all you're going to do is track down Leonard Nimoy Station in *Elite: Dangerous*, then the ultra-wide AOC will be more than enough screen for you. But if you want to do anything more seriously productive, this more expensive Philips is a great monitor.

■ Dave James

Verdict

Features	★★★★
Performance	★★★★
Value	★★★★

Glorious IPS panel; dramatic 21:9 ratio; deep pro-configuration options; good-looking design.

★★★★

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Seagate Personal Cloud 2-Bay

We got personal. We did not double our fun.

If you've been reading the papers, you've noticed our privacy isn't as private as we thought, especially when we use the internet. In response, some storage companies now offer "personal clouds" to replace cloud services like Google Drive and Dropbox. This is basically a hard drive or SSD that's connected to your local network at home, and you can access it remotely and transfer files back and forth. It's not as reliable as a global network of data servers with redundancies and fallbacks in case of hardware failure, but there's no monthly fee, and you know exactly where your data is and who's looking at it.

The Seagate Personal Cloud 2-Bay is an enclosure with two drives in it. We tested the 4TB version, which defaults to RAID 1. It's about 5cm tall and 20cm squared, so it needs a moderate amount of real estate. You'll find a Gigabit Ethernet connector and one USB 2.0 connector in the back, and one USB 3.0 connector on the side, the latter of which is kind of an odd placement.

For setup, you're pointed to a web site (**www.seagate.com/personalcloud-setup**) where you'll find several YouTube videos and PDFs await, though we had to dig around to find the actual steps for the setup process. We eventually discerned that you must also wait up to 10 minutes before the device shows up on the Wi-Fi portion of your network. After two firmware updates (each requiring a reboot) and choosing between RAID 1 and RAID 0, we went ahead and created a Seagate Access ID to access the device remotely. This turned out to be unrelated to the Sdrive software, which for some reason requires its own ID and password.

The Sdrive desktop software reportedly hooks into the Sdrive app for Android and iOS. Not to be confused with the Seagate Backup app, which uses a Seagate Account instead of a Seagate Access ID or Sdrive login. And on the desktop, there's also a Seagate Dashboard client. Which you can't use without registering the device. The device also has a web interface that operates independently of all this. You can't do backups there, but you can see the device's network settings, which are exhaustive.

Sdrive stubbornly resisted all attempts to connect our devices to the drive. The Seagate Backup app could coordinate with the Seagate Dashboard in theory, but it failed to detect the drive when on the local network. Eventually, we stumbled upon yet another piece of software, the Seagate Media App. Using our Seagate Access ID credentials, we were able to instantly see the drive both over Wi-Fi and over a mobile network, the latter of which even supported streaming videos. The 2-Bay actually works well enough as a locally networked storage backup device. That part of the Dashboard software is pretty sensible for creating, restoring, and maintaining local backups. And the built-in RAID redundancy is a nice feature. But the actual "cloud" part of things made us want to lie down and stare at the ceiling.

■ Tom McNamara

Verdict

Features	★★★☆☆
Performance	★★★☆☆
Value	★★★☆☆

Local backup software works well; RAID redundancy built in; poor setup and usage experience.

★★★☆☆

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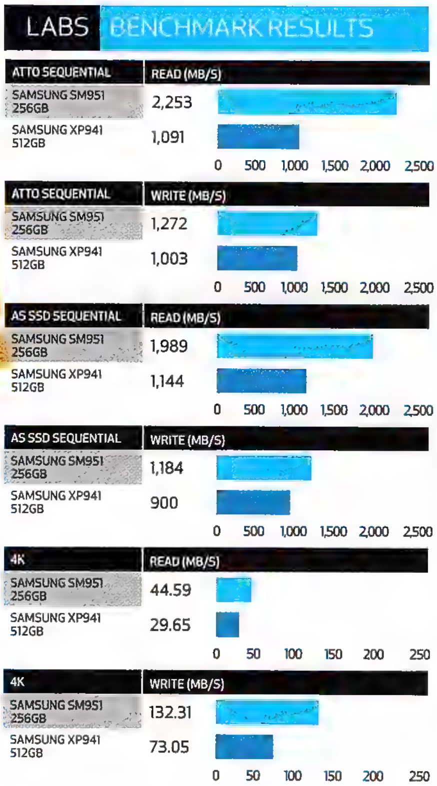

apc HOT PRODUCT

SSD

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Samsung SM951

Another blisteringly fast, but slightly easier-to-find, Samsung M.2 PCI-Express SSD.

The SM951 M.2 drive first saw the light of day at Samsung's SSD Global Summit, which took place in Seoul, South Korea, in July last year. When it was first announced, the company claimed it would be the world's first NVMe SSD for the PC, but that idea sadly got dumped, as the drive only supports the good old AHCI architecture.

The drive comes in three capacities: 128GB, 256GB (reviewed) and 512GB, and all are the M.2 2280 format (22 x 80mm).

The XP941 used a 3-core Samsung S4LN053X01 controller with a PCI-Express 2.0 x4 interface. The SM941, meanwhile, uses a Samsung S4LN058A01 controller, again a 3-core chip, but with a PCI Express 3.0 x4 interface. So what does moving from 2.0 to 3.0 PCIe do? Well, in theory it doubles the bandwidth – you only have to look at the quoted sequential read/write performance figures to see the advantage of the 3.0 interface. The 256GB XP941 is quoted as up to 1,080MB/s and 800MB/s for read/writes respectively, while the 256MB SM951 surpasses that by some distance with figures of 2,150MB/s reads and 1,200MB/s writes. But while this drive has humongously fast sequential speeds, it remains way off the 3.2GB/s maximum bandwidth of the 3.0 x4 bus.

Surprisingly, given what Samsung is doing with 3D-NAND, the SM951 uses old-fashioned 2D planer 10nm class MLC NAND, in all probability the same 19nm 64Gb MLC NAND used in the XP941. Also added to the SM951 is support for the PCIe L1.2 power state, which can be looked at as the PCIe equivalent of DevSleep that's supported by some standard SSDs. Another advantage of the SM951 over the previous model is that it's bootable (with the right motherboard that is), so make sure you do your homework before buying either drive or motherboard.

To test the drive at its full x4 PCIe potential, we used an Asrock Z97 Extreme6, one of the few Z97 boards that can run these drives at full speed, thanks to its additional M.2 x4 port. Alternatively, there's Intel's X99 chipset or, failing that, you could always use an adaptor card such as the Lycom DT-120.

It takes some believing, but even the quoted figures for the sequential reads seem a little conservative when the drive was tested with the ATTO benchmark, producing a score of 2,253MB/s. However, the write performance was pretty much bang on the money at 1,272MB/s. When it comes to handling the small 4K files of everyday use, the SM951 shows once again the advantage of the extra bandwidth available to it with a read speed of 44.59MB/s, in the AS SSD 4K test, but the biggest improvement comes in the write figures. The XP941 gave up a score of 73.05MB/s, which is totally eclipsed by the 132.31MB/s produced by the SM951.

All these figures add up to make the SM951 an incredible SSD. In fact, the only thing that's holding us back from going weak at the knees, is the promise of the imminent NVMe version.

■ **Simon Crisp**

Verdict

Features	★★★★
Performance	★★★★★
Value	★★★★

The fastest M.2-based drive we've tested to date and certainly the fastest 256GB consumer drive around.

★★★★½

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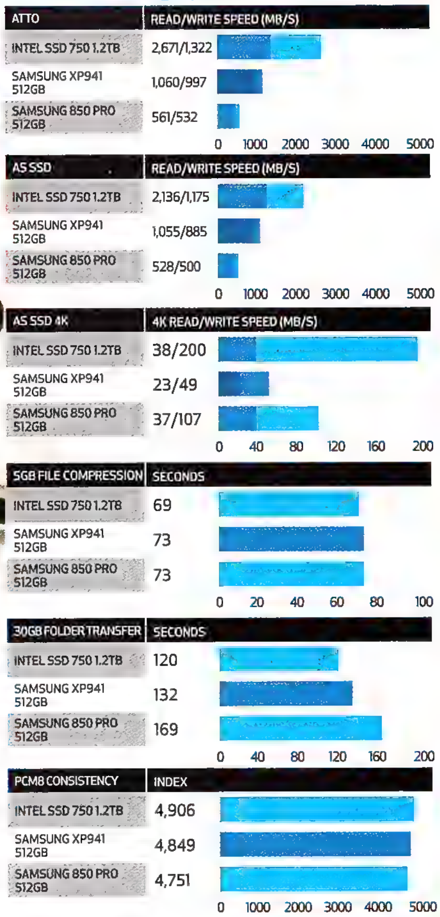

ATTO	READ/WRITE SPEED (MB/S)
INTEL SSD 750 1.2TB	2,671/1,322
SAMSUNG XP941 512GB	1,060/997
SAMSUNG 850 PRO 512GB	561/532

AS SSD	READ/WRITE SPEED (MB/S)
INTEL SSD 750 1.2TB	2,136/1,175
SAMSUNG XP941 512GB	1,055/885
SAMSUNG 850 PRO 512GB	528/500

AS SSD 4K	4K READ/WRITE SPEED (MB/S)
INTEL SSD 750 1.2TB	38/200
SAMSUNG XP941 512GB	23/49
SAMSUNG 850 PRO 512GB	37/107

5GB FILE COMPRESSION	SECONDS
INTEL SSD 750 1.2TB	69
SAMSUNG XP941 512GB	73
SAMSUNG 850 PRO 512GB	73

30GB FOLDER TRANSFER	SECONDS
INTEL SSD 750 1.2TB	120
SAMSUNG XP941 512GB	132
SAMSUNG 850 PRO 512GB	169

PCM8 CONSISTENCY	INDEX
INTEL SSD 750 1.2TB	4,906
SAMSUNG XP941 512GB	4,849
SAMSUNG 850 PRO 512GB	4,751

Wipe the slate clean. That's the thinking behind the latest SSDs from Intel. Forget the SATA interface and forget the AHCI protocol, this is high bandwidth NAND Flash-specific storage of the highest order. This is solid state all grown up and forging its own path, free of the past.

That problem with the current crop of 2.5-inch SSDs is that the SATA/AHCI setup was intended for mechanical storage drives, but even with an SSD in place the legacy commands in AHCI still have to be run through. The drive then has to go through each legacy command, even if they have no relevance to high-speed SSDs. It wastes an awful lot of CPU cycles.

Intel's DC P3700 enterprise class SSD forms the basis of this first consumer NVMe drive. The bespoke controller at the heart of the P3700 is the same 18-channel controller as the one that makes the SSD 750 so speedy. That controller is kept honest with a hefty 2GB of DDR3 cache on this 1.2TB version.

So what is top speed? The peak sequential numbers from ATTO are astonishing. The reads were almost 2.7GB/s and the writes were a little over 1.3GB/s. Inevitably the average scores on the more testing AS SSD benchmark were lower, but 2.1GB/s and 1.2GB/s respectively is hardly bad. We're quickly shifting away from talking in MB/s here…

There are some interesting scores when we get to the 4K random read/write performance though. At 38MB/s, the 4K random read speed is nothing to write home about, but the write performance of 200MB/s is stunning.

Compare all that with the fastest PCIe drive we've previously tested, the Samsung XP941, and you can see where the AHCI protocol is holding things back. Its 4K write performance is a quarter of what the SSD 750 can achieve.

There we have it then. Intel's SSD 750 is the fastest SSD we've ever tested and by a pretty comfortable margin too. It is, however, also one of the most expensive. The problem with being a brand new technology, and being first to market, is that it will always command a supremely high price tag.

But there's a certain justification for it. Intel has had to invest heavily in the ecosystem of NVMe, working behind the scenes to ensure all the mobo makers are able to get BIOS support for their Z97 and X99 boards. The SSD makers who will follow up with inevitably cheaper NVMe-based SSDs won't have that R&D cost.

The SSD 750 also shares the basic core silicon with its pro-class brethren, the P3700, so it's got similar levels of performance. But the 1.6TB enterprise drive is well over $5,000, while this high-capacity, high performance drive is just $1,600. Looking at the cost per GB makes it look less extortionate. When Intel released the X-25M, the first real performance SSD, it cost $5 per GB. This 1.2TB drive costs a far lower $1.33/GB.

And prices will tumble. This is the birth of NVMe. The ecosystem is there now, so you can bet NVMe-based SSDs will be appearing from every manufacturer by the end of the year – once Marvell and SandForce's controllers are out there it's going to go crazy. June's Computex is likely to be built upon a sea of NVMe drives… And we also doubt this is as fast as an NVMe drive can get too. Without comparisons for now though, this is as quick as it gets.

■ Dave James

Verdict

Features	★★★★
Performance	★★★★★
Value	★★★★

Supreme storage performance; simple to use; huge capacity; decent value.

★★★★½

GAMING HEADSET

$89 | WWW.GIGABYTE.COM.AU

Gigabyte Force H3X

A stylish headset that manages a surprising amount of power.

The 50mm drivers powering the Force H3X make it a beast in the audio stakes.

For $89, this is a really well-rounded package. All contact points are padded generously and finished with a leather effect around the cups, while the exterior boasts a mirrored detail.

The basic but functional inline remote features a volume slider and mic on/off toggle switch. There's a bit of creakiness when adjusting to fit, which reminds us of its budget pricing, as does its basic rubberised cabling.

It's a success by a much narrower margin in audio quality. Two beefy 50mm drivers power this stereo headset, so it certainly isn't wanting for low-end. The H3X absolutely threw out bass during our testing playlist. High-end frequencies are well voiced too – we wouldn't quite say they 'sparkle', but the details aren't lost. However, in order to achieve that balance, there's a noticeable lack of warmth indicative of a 'scooped' EQ – in other words, boosted high and low-end frequencies and a dip in the mid-range. This hardwired EQ can lead to compressed audio – from music streaming services, say, or YouTube videos, sounding even more lossy than they actually are, and ultimately affects the versatility of this headset.

The retractable mic is also a nightmare to pull out and push back in again. We found the mic quality reasonable, but prone to scratchiness when moving the adjustable arm.

Given its considerable pros in build quality elsewhere, plus design and sound quality, it's certainly worth keeping this one in mind if you don't use VoIP much. ■ **Phil Iwaniuk**

Verdict

Strong bass response and high end will liven up shooters.

★★★½

apc
HOT PRODUCT
GAMING HEADSET

$149 | WWW.KINGSTON.COM

Kingston HyperX Cloud II

King of cans, back with 7.1 surround.

Did we ever mention how much we love Kingston's luxuriant HyperX Cloud headset? Right. All the bloody time. It's a rare combination of audio and ergonomic engineering working in perfect harmony. Sure, they're little more than a revision of QPAD's QH-90 headset with more bass and branding, but the results are so good we can let all that go.

The HyperX Cloud II is a revision on the original HyperX Cloud revision, updating the visuals, refining the inline remote and adding virtual 7.1 surround sound. All the things we liked about the original model are still here.

The heart of the matter lies in the HyperX Cloud II's surround capabilities. Rather than jam each earcup full of individual drivers, Kingston opts for an inline sound card offering virtual 7.1 surround. The surround effect can be toggled on or off, which is handy if you're trying to perceive the exact effect it's having. How's it sound? Well, you'll want to stick to a stereo output for music, since there is a perceptible dip in fidelity with surround enabled. But if you want to lose yourself in a movie's surround mix or feel the war shaking your bones in a shooter, it's great.

And that's largely down to the original construction and driver quality. This isn't the most impressive virtual surround tech we've heard. However, combined with the existing low-end power and clarity further up the EQ, it makes for just about the best overall package out there.

Surround is the only meaningful difference between the two models, so if you own the originals there's no real need to upgrade. ■ **Phil Iwaniuk**

Verdict

Original benefits intact; solid surround.

★★★★½

SEE THE LIGHT

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LED | Patented LED RED | LED | Patented LED WHITE

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software

» APPS FOR ALL THE PLATFORMS

Windows SOFTWARE

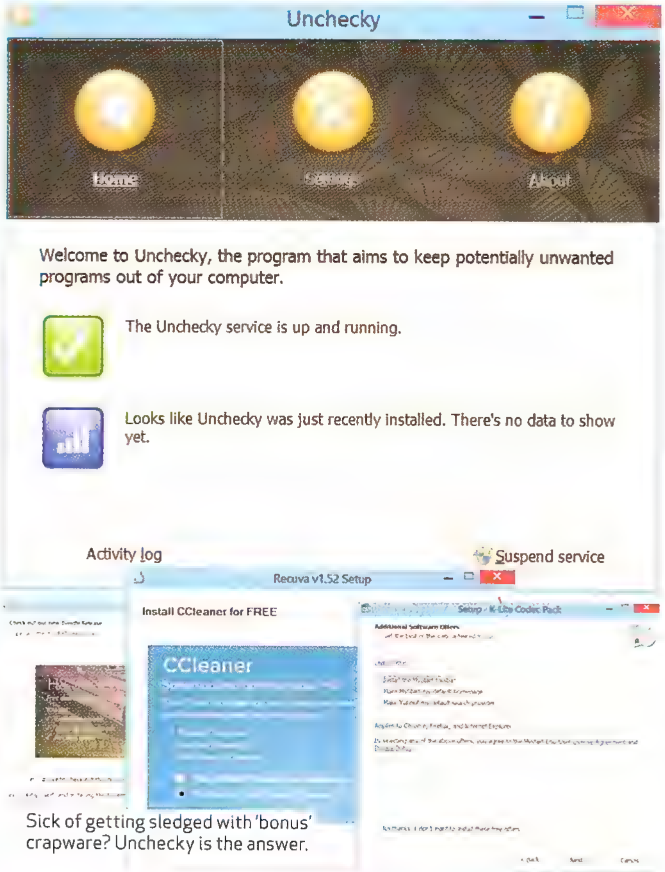
Unchecky

Like to try out free software? Install this first…

FREE | UNCHECKY.COM

Unchecky is a program that we've mentioned in passing once or twice in our Q&A replies, but for any of our readers who've missed it and don't have it installed, we thought it deserved a proper full write-up here. You can think of Unchecky as a kind of spam filter, but not for emails – this one stops spammy 'junkware' applications from being installed in Windows.

There's been a growing problem with free software over the last few years. While there's a heap of good programs available for Windows, many now try to monetise themselves by bundling in free 'extras' – such as annoying browser toolbars, changing your search engine or even Bitcoin miners. If you're not careful, it's possible to accidentally install these along with the application you actually want. Unchecky fixes this by automatically unchecking the relevant boxes within installers. The app's relatively simple in execution. Once you've installed it, it runs as a system service and lives as a tray icon – the actual Unchecky program doesn't have anything to configure and automatically updates itself when there's a new version. It isn't quite infallible – so obviously, we'd still recommend you keep an eye out for unwanted offers – but Unchecky drastically reduces the risk of your Windows system contracting unwanted crapware. It's a must have. **Dan Gardiner**



Welcome to Unchecky, the program that aims to keep potentially unwanted programs out of your computer.

The Unchecky service is up and running.

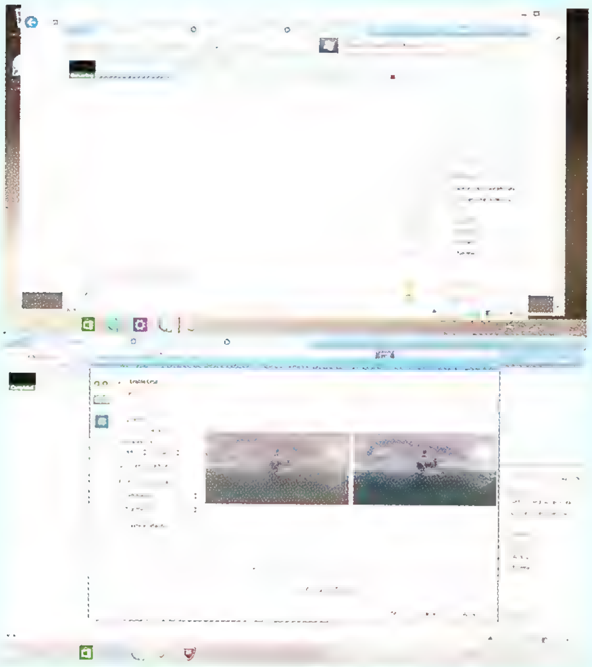
Looks like Unchecky was just recently installed. There's no data to show yet.

Sick of getting sledged with 'bonus' crapware? Unchecky is the answer.

Any Video Converter

FREE | ANY-VIDEO-CONVERTER.COM

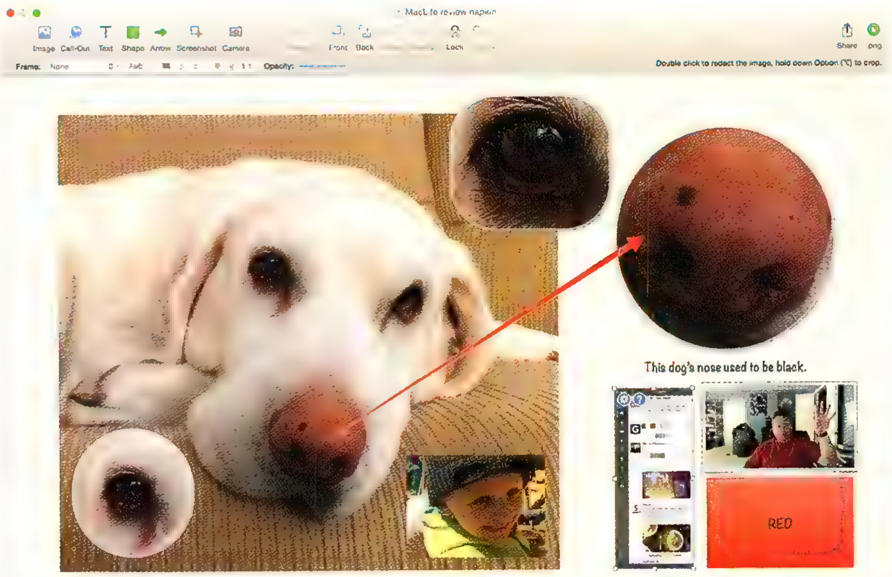
Unlike pictures and music, video files don't really have a standard file format. Not only do different video camera technologies record movies in different formats, but each playback device will have its own in-house or preferred media player that often requires a specific file format — Apple's iOS is particularly picky about what videos it can play back, for example. Fortunately, free applications like Any Video Converter (AVC) can take a bit of the headache out of this video currency conundrum. After downloading a .webm file from YouTube, for example, the in-built playback window in AVC will let you play this unusual format back where many others won't… though it takes a little longer than expected to load and play — it obviously has to convert it into its preferred video format. That said, AVC app isn't really intended to be a media player and fully converting movie files through AVC is reasonably speedy. There are also hundreds of different files you can convert to and the outputs are organised into device-compatible formats, so you can quickly select the file format depending on what device you wish to play it on. An additional basic video editor, lets you crop or reformat the video to another aspect ratio. This all adds up to make AVC an excellent freeware tool for handling different video formats. **Joel Burgess**



Napkin

Take ideas from your brain to the page with consummate ease

$39.99 | AGED-AND-DISTILLED.COM



Double click to redact the image, hold down Option (⌥) to crop.

This dog's nose used to be black.

Armed with an elegant set of markup tools, Napkin allows anyone to convey ideas or explain concepts in a more ambitious way than words alone.

For starters, you can draw lines or shapes with a mouse and Napkin will convert those scribbles into clean, vector-based arrows, text boxes or callouts. These can be embellished by importing images from your Mac or using the built-in screenshot feature to grab some or all of the display.

You can crop, pixelate or blur imported images in the app itself, while sharing your final creation is also easy thanks to the Share menu and the ability to drag and drop JPEG or PNG versions between apps.

Napkin makes short work of creating callouts. Draw around the area you want to draw the viewer's attention to, click to lock it, then drag it into position. Arrows drawn between objects retain links when one is moved, and smart guides make it easy to reposition elements.

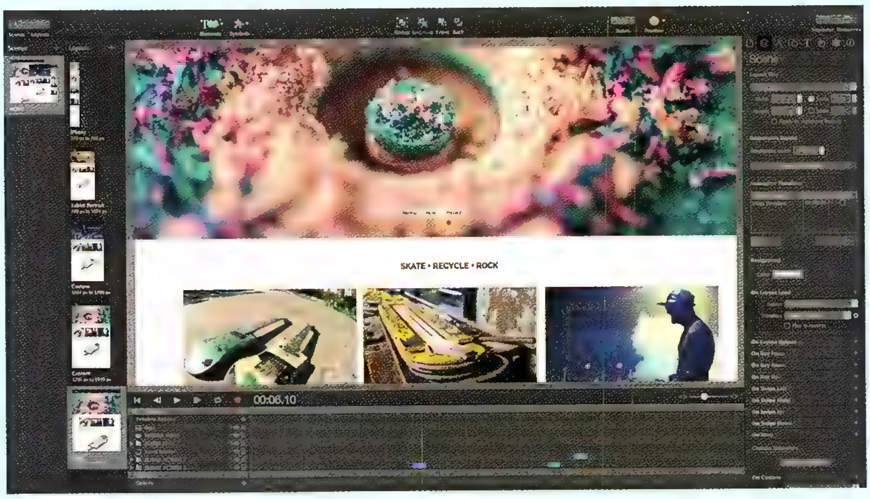
The app is priced at $39.99 and you can't try before you buy. The cost of admission feels exorbitant compared to free markup apps like Skitch – that is, until you spend time with Napkin and realise what an effortless timesaver it really is.

However, there's no way to import PDF files, and keyboard jockeys will lament the lack of shortcuts while taking screenshots.

J.R. Bookwalter

Hype 3

$64.99 (PRO) | TUMULT.COM



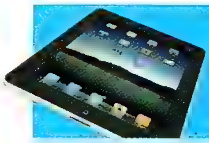
Tumult's Hype 3 is an HTML5 design and authoring tool with an emphasis on animation and interaction. With timeline features similar to early versions of Adobe Flash, it can be used for eCards, presentations, web site creation, iBooks content and even simple mobile apps. Hype 3 Standard is a free upgrade for previous owners of Hype.

Hype makes animation easy — slap an element on stage, whether it's an image, a shape or some text, then hit the big red record button. Move the playhead along and animate the object by moving it, manipulating it and changing its opacity or colour. Hype does the gruntwork for you, filling in the gaps. Everything you create in Hype uses HTML5 functions, so you can view the output in a web browser with no plug-in required.

You can upgrade Hype 3 Standard to Pro, but most of the extra features are pretty fundamental and the kind of thing you'd expect as standard. When features as basic as layout grids are Pro only, it does feel like rationing for the sake of it.

Fortunately, not all of Hype Pro's unique features are so mundane; it's worth the extra just for gravity-based animation. You can add gravity to any element, making it responsive to device tilt and orientation, no keyframing required — with collision detection built-in too.

Karl Hodge



Hours

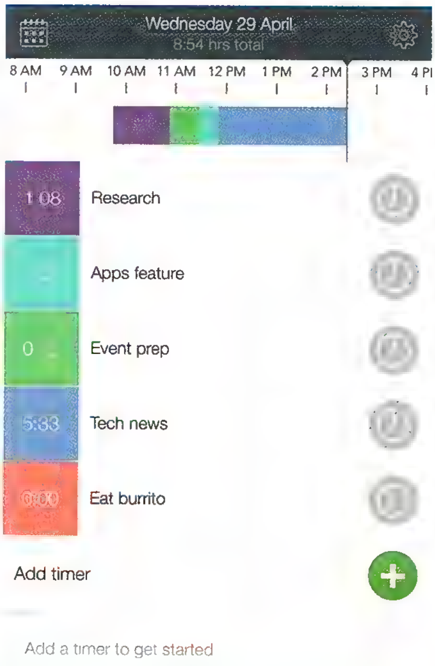
The class-leading time tracking app has recently gone free.

FREE | WWW.HOURSTIMETRACKING.COM

Whether you've been tasked with keeping track of business meeting minutes, or you need to track your work hours in order to bill your employer, or maybe you simply want to track your day for your own benefit, Hours is just about the easiest and most effective way to do so. And now that it's free, it's also the cheapest.

Winner of the Apple Design Award in 2011, Tapity's app lets you create colour-coded Timer blocks for your projects which you can apply tasks and client information to. Once you've set it all up, simply hit the timer icon next to a project to start keeping track of the time you've spent on it. You can see the total time spent on a project in its corresponding block, and at the top of the screen you'll find a colour-coded timeline that quickly shows you the day's combined task time. Hours is an invaluable productivity app that we recommend spending some time with.

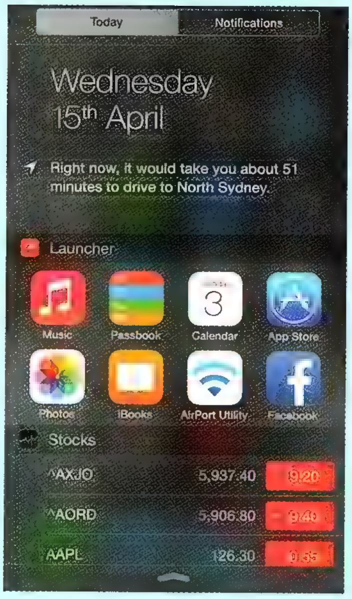
Stephen Lambrechts


Wednesday 29 April
8:54 hrs total
8 AM
9 AM
10 AM
11 AM
12 PM
1 PM
2 PM
3 PM
4 PI
1 08
Research
Apps feature
0
Event prep
5:33
Tech news
Eat burrito
Add timer
Add a timer to get started

Launcher

FREE | TINYURL.COM/M8OAUCC

Despite immense popularity at… err… launch, the iPhone Notification Centre customisation app Launcher originally had a short life on the App Store. It was unfortunately removed by Apple on the grounds of it being a "misuse" of widgets (whatever that means). Fans of the app can finally rejoice, as Apple has reversed its decision on Launcher, allowing it back on the App Store. Now, you can create the Notification Centre you've always dreamed of. Launcher lets you create two rows of shortcut in the free version, and five rows in the Pro version ($4.99). Contact Launchers give you fast access to contacts of your choice, App Launchers lets you embed your most used apps, Web Launchers let you set shortcuts to web pages, and Custom Launchers let you perform specific tasks in a heartbeat.


Today
Notifications
Wednesday
15th April
Launcher
Music
Passbook
Calendar
App Store
Photos
iBooks
AirPort Utility
Facebook
Stocks
^AXJO
5,937.40
9.20
^AORD
5,906.80
9.40
AAPL
126.30
0.55

Right now, it would take you about 51 minutes to drive to North Sydney.

Launcher does take a little bit of tinkering to set up, however once it's sorted, you'll love how quickly you can perform all of your phone's daily functions.

Stephen Lambrechts

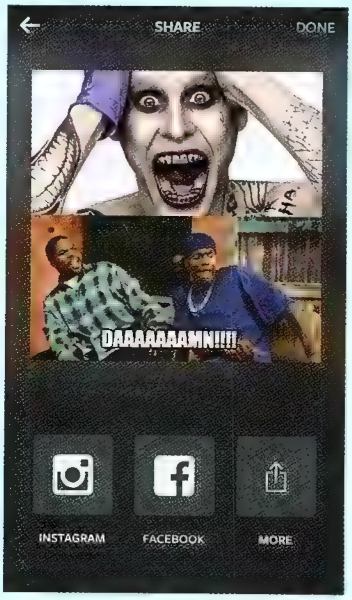
Layout from Instagram

FREE | TINYURL.COM/M8OAUCC

Keen Instagrammers know that there are countless collage making apps available on the App Store that let you stitch multiple pics together in funky ways, but now we finally have an official one — Layout from Instagram.

While Layout is a little more restrictive than most other collage apps when it comes to its number of layout options, just like with Instagram itself, it gives you a chance to follow the old "creativity is born of limitation" maxim.

Simply start selecting the images you want to use in your collage on the bottom half of your screen, and the app will instantly generate some layout options depending on how many pictures you want to use. Next, you can fine tune each segment of your layout — tap the portion you want to adjust and you can resize, mirror, flip or replace the image.


SHARE
DONE
HA
DAAAAAAAMN!!!!
INSTAGRAM
FACEBOOK
MORE

Once you've created your image, you can share it straight to Instagram, Facebook and more. Layout from Instagram is clean and elegant.

Stephen Lambrechts

PHILIPS

Big on details

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Google Play » ANDROID

Google Handwriting Input

Put your touch keyboard away, granddad.

FREE | TINYURL.COM/N5ZO2ZK

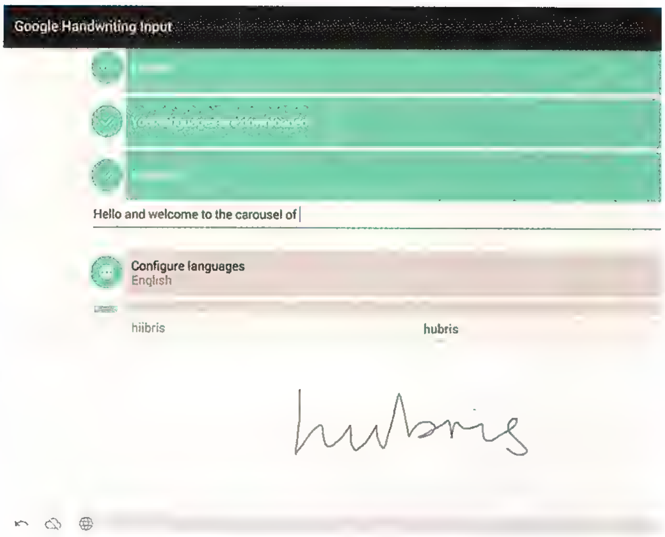
Let's just put this out there – no one types these days. What is it, 2008? Handwriting on touchscreens is what all the cool kids are doing, so maybe you should download the Google Handwriting Input tool for Android devices and let the kids know you can be hip, too.

Google Handwriting Input lets you configure your device so that you can use a fine point stylus, or even your digits, to handwrite across all of the apps that allow for text input. It even recognises the emoji that you draw (depending on your art skills).

Handwriting works better than you'd expect, too. I scribbled in my usual messy, cursive style and it almost always understood me. Punctuation can be a bit tricky, but that's about it. No "Eat up Martha" situations to speak of here, Simpsons fans.

And if it doesn't capture your words exactly, it will also predict a couple of other possible options to select with a single tap.

Stephen Lambrechts



Google Handwriting Input

Hello and welcome to the carousel of

Configure languages
English

Drippler

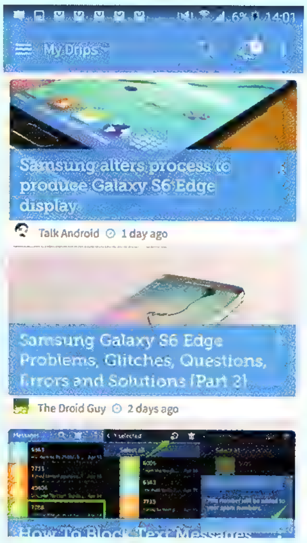
FREE | TINYURL.COM/P579DC7

Got a new Android phone and want to keep up to date on all the latest news, firmware updates, apps, tips, and accessories for that specific phone? Drippler will detect exactly which model of Android device you have as well as which carrier it's on, and keep you completely in the loop about it.

This information is presented to you in a visually-driven feed that's slick and pleasant to browse (you can even set a preferred font-style). Each time you open something from it or install an app it suggests, Drippler gets a better understanding of the type of stuff you're into for next time. Soon enough, you'll know everything there is to know about your device.

Originally on iOS, Drippler is extremely useful in the fragmented Android market, where different devices become compatible with different firmwares and apps at different times. If you were previously an iPhone user and have jumped ship over to an Android, you might just find Drippler to be invaluable.

Stephen Lambrechts



Samsung alters process to produce Galaxy S6 Edge display

Talk Android 1 day ago

Samsung Galaxy S6 Edge Problems, Glitches, Questions, Errors and Solutions [Part 2]

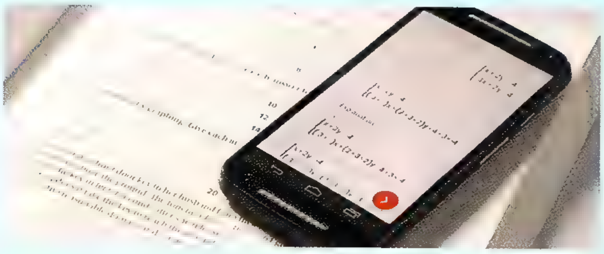
The Droid Guy 2 days ago

How To Block Text Messages

PhotoMath

FREE | TINYURL.COM/APC416-PMATH

By our reckoning, optical character recognition (OCR) is a technology that is woefully under-used in the mobile app space. Google updated its Translate app earlier in the year to add in a camera translation service — allowing the translation of street signs, menus and other printed text — and this marked a significant step forward in the applications of OCR. Although PhotoMath by Microblink has garnered less attention, it's arguably an equally-impressive offering — well, at least if you're a bit of a maths geek. Using your smartphone camera, PhotoMath can identify written maths problems and solve them for you in real time. With the ability to recognise squares, decimals and two-sided equations, this beta phase application can already tackle a respectable portion of maths problems, but the developers say they intend to expand this further. When we tack on consideration for the app's step-by-step feedback — which gives its workings for how it actually solves each equation — PhotoMath has the potential to be an integral app for anyone who interacts with maths on a regular basis. **Joel Burgess**



Lumia Beamer

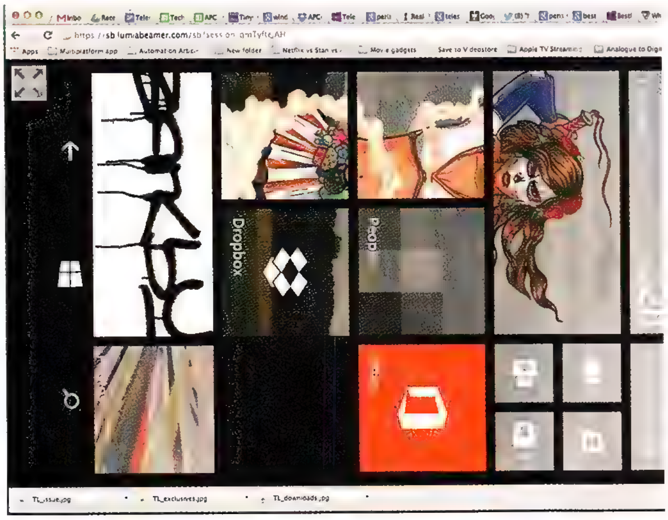
Beam pics anywhere.

FREE | tinyurl.com/APC416-LBeam

There are a few apps that set out to share copies of what's on your Windows Phone's screen with other devices, but none are quite as simple as the Lumia Beamer app. Using the device you want to cast to, you can punch lumiabeamer.com into a web browser and a unique QR code will appear. From there, this Microsoft-developed app scans the code and then shares a continuous flow of screenshots from your phone to whatever device the browser window is open in.

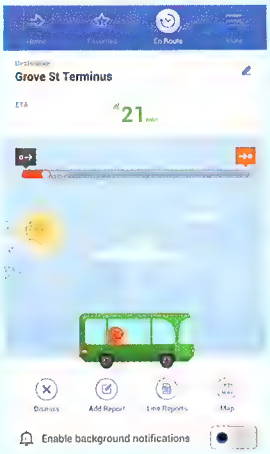
A shake-to-upload setting is great for showing others select photos from your phone, while the auto-upload feature allows you to focus on a task – like playing a game, for example – while sharing a regular stream of screenshots. If you're going for a run and you want to let someone know where you are, you can plug the app into Here Maps and upload your current map coordinates. The app also lets you share what you're seeing by connecting directly to your phone's camera. Lumia Beamer achieves what it sets out to and though this is just an update, it has helped reinvigorate what is a quite unique (and extremely well-designed) Windows Phone app.

Joel Burgess



Moovit

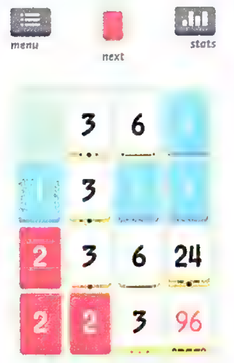
FREE | TINYURL.COM/APC413-MVIT



Judging by the conspicuous orange design of Mooveit's logo, this new free app seems to be aiming to usurp the stronghold of Australia's popular home-grown transport companion, TripView. When you consider that TripView costs about $4, a free competitor sounds mighty good. Unfortunately, the similarities between Moovit and TripView end at that orange logo. Moovit has three main sections: a journey planner, a timetable and a favourite stop list. Though initially sounding promising, it soon becomes clear that the way you find timetables in Moovit is closer to Google Maps, rather than the simpler 'saved trips' approach of TripView. The app's layout also means it's more suited to discovering new public transport routes than actually being useful in everyday commuting. Considering that Google Maps is free, has almost identical features and can be used to find public transport in almost every country you have to wonder why Moovit would bother. This app may have a place on the Windows Phone platform, since there's no official Google Maps app, but for Android and iOS it's hard to see the value added. **Joel Burgess**

Threes

FREE | ASHERV.COM/THREES/



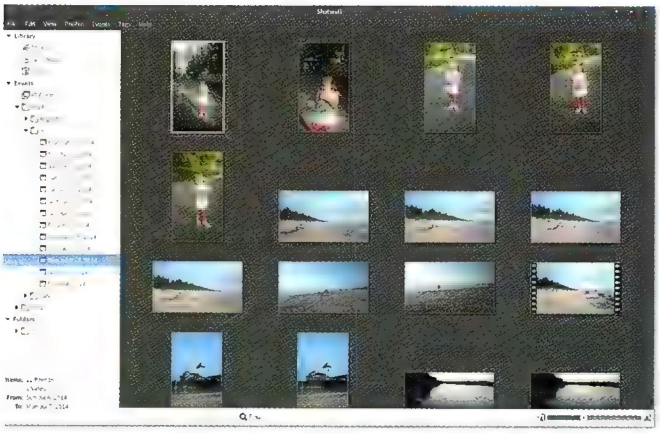
PAY ATTENTION TO THE UPCOMING CARD

You may have seen, heard of or played the popular Sudoku-come-Rubix Cube, arithmetic puzzle game, 2048. If you felt it was a stripped down game with good mechanics but no real frills, you probably won't be surprised to learn that 2048 is basically a clone of Threes: a slightly different, 14-months-in-the-making, highly-polished puzzle game that appeared first on iOS and even won Apple's game of the year award in 2014. Unlike 2048, Threes has an appealing and colourful design and a decent soundtrack (which incidentally, the devs believe is good enough to download independently) making 2048 seem like a drab accounting game in comparison. The mechanics are a little easier in Threes too, as you can shift tiles just one space rather than slide them across the whole board. That said, there are more tiles to navigate and surprisingly large numbers can pop into existence on a whim. Even if you happen to already be a 2048 tile-shoving visionary, Threes is potentially different enough to reinvigorate a numerical love-affair during your daily commute. Considering it's currently free for Windows Phone, Threes is a noteworthy addition to the platform. **JB**

Shotwell

Manage your photos in Gnome.

FREE | WIKI.GNOME.ORG/APPS/SHOTWELL



Shotwell has been around since 2009, when it replaced F-Spot as the default application for personal photo management in Gnome. It's a lean and neat GTK application made with simplicity firmly in mind, being geared towards supplying the most essential image-handling features.

For instance, Shotwell can import photos and videos directly from a digital camera using either USB mass storage mode or MTP mode. Once imported, files land in your Pictures directory and Shotwell automatically groups photos and videos by date, and displays them, much like you would expect from a file manager, with large thumbnails. The left bar is used for navigation between date-based albums while the main window area shows the contents of the current album.

As soon as the Nautilus file manager was cut down in recent releases, Shotwell took over the job of browsing photos. This is thanks to its conventional tree view and fast generation of thumbnails, which supports videos and even RAW photos. Shotwell is capable of much more, of course: it can organise your files by time-based events, tags (keywords), folders, and search and remove duplicates. It also enables you to do basic enhancement and editing tasks (such as crop, rotate, adjustments, colour, straighten etc), view slideshows and share your photos to major web services, including Facebook and Flickr.

In version 0.22 the Shotwell developers have improved metadata support in a number of ways: uploading your photos to Facebook now supports tags and titles, and the application is now capable of importing exposure time and the title of photos if available.

Moreover, Shotwell 0.22 brings a handful of other improvements and bug fixes, such as proper support for text is-set and text not-set options when saving searches, the ability to sort photos by filename and various minor cosmetic improvements to the GUI.

For Ubuntu and its family the Yorba Foundation offers a PPA (ppa:yorba/ppa), which support all modern releases. Other distros also received Shotwell together with new Gnome apps stack, so check your package manager for updates. **Alexander Tolstoy**

VirtualBox

FREE | TINYURL.COM/416BOX

For a number of months there has been a growing concern about the stalled (or just very, very slow) development of the famous VirtualBox software, and it's been a long time since we last heard of any major innovations or improvements to VirtualBox, ever since Oracle acquired Sun Microsystems in 2010.

Although VirtualBox was backed by Oracle with all its corporate power, the software has been open source, which gave us hope that we would see improvements and it seems that it's finally time for some big changes: Oracle has unveiled the beta version of VirtualBox 5.0 and with it para-virtualisation support for Windows/Linux guests to improve performance.

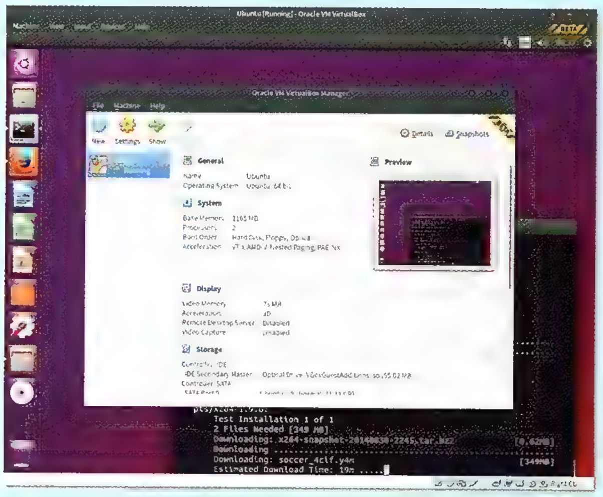
This beta also exposes various new instruction set extensions to the guest VMs; adds USB 3.0 device support into the XHCI controller, bi-directional drag and drop support for guests and disk image encryption support. There are various GUI improvements too and HiDPI screens support, and a large number of welcome bug fixes.

The hottest feature in version 5.0 is the para-virtualisation support, which can be accessed in the 'System > Acceleration' section of virtual machine settings. VirtualBox offers several interfaces for para-virtualisation, such as Legacy, Minimal, Hyper-V (Windows) and KVM (Linux).

Para-virtualisation provides specially defined hooks that enable guest systems to access parts of the host's hardware directly, thus boosting the performance. In our tests, the new VirtualBox version showed noticeably better speed of a guest operating system, together with much lighter CPU usage on the host's side.

Installing the 5.0.0_BETA1 is very straightforward. Although a source tarball is available in the link above, Oracle has helpfully offered a large set of pre-compiled packages for the most widely used enterprise Linux flavours and some desktop systems as well.

There are ready-to-install packages for RHEL 5 through 7, Fedora, OpenSUSE, SLES, Ubuntu and Debian RPMs and Debs, as well as an VirtualBox Extension Pack and Guest Additions ISO for version 5.0.0 beta1. **Alexander Tolstoy**



```
Test Installation 1 of 1
2 Files Needed [349 MB]
Downloading: soccer_4cif.y4m                    [349MB]
Estimated Download Time: 19m .....
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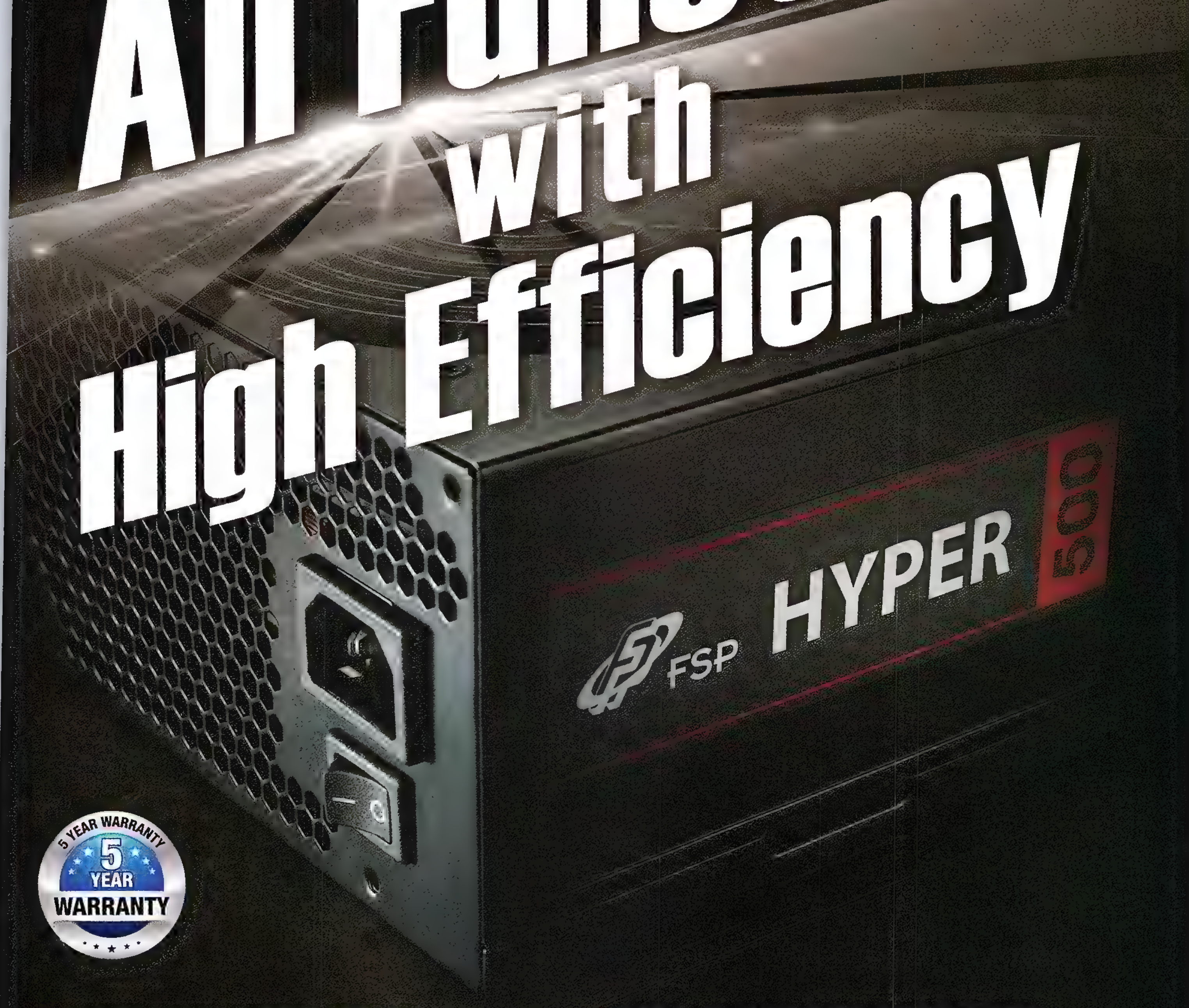
FSP
POWER NEVER ENDS

500W/ 600W/ 700W

All Function with High Efficiency



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◆ **+12V SINGLE RAIL**

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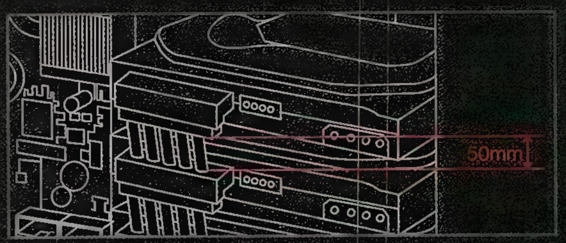
120mm long lasting fan provides superior cooling, noise <19bBA at 50% loading.

◆ **SATA ARRAY CABLE DESIGN**

50mm intervals for SATA device installation, to optimize the airflow inside the case and no-hassle with case side panel.



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PHOTECHCOMPUTERS

Remote access apps

Stephen Lambrechts checks out how to control his computer when he's nowhere near it.

We live in a world where some sort of computer is never more than an arm's length away, whether it's your phone, your tablet or even your watch. But sometimes, you have to perform tasks that need an honest to goodness, full-featured computer. Other times, you need access to files that you don't have on you, or maybe you want to make sure that a large file that needs downloading or transferring is ready and waiting for you when you get home. Whatever the reason, remote access programs give you direct control of your computer from the devices you carry with you everyday, when you need it most.

So how does remote access work? Desktop sharing is made possible via a server component, which is installed on the computer you wish to control, and a client app (or viewer) that's installed on your remote device.

Once a network connection is made between the client and server, everything you do remotely is replicated exactly on your server PC.

Traditionally, the remote client device was a PC or laptop, but most remote access platforms now let you use a smartphone or tablet as well.

Maintaining control of a PC from your handheld device is surprisingly easy. While each remote access app has its own specific way of doing things, for the most part, you can control your PC's mouse cursor by dragging your finger around on the screen – some even give you the option to skip the cursor and just tap the things you want to click on. Your device's touchscreen keyboard can be used for any text that you need to input.

Access to your computer isn't open to everyone, though. Your server computer needs to have given login permission to the client computer or device that wants to remotely access it. This usually involves setting up a unique PIN or password, which the remote device will need to know in order to get in. This provides a layer of security to the desktop sharing experience.

There are numerous factors involved in choosing the right service for your needs. Some remote access apps are free of charge, but might not offer everything you need. Other services are subscription-based, for which you'll need to pay a monthly or yearly fee. Another chief concern is convenience and ease of use – you'll want a service which will give you access to your server from whichever device you happen to be using, whether it's an iOS, Android or Windows smartphone or tablet.

With that in mind, we've taken the liberty of testing and reviewing the most popular and well-regarded remote access apps available to help guide you to the right service for your needs. Given how mobile we've all become, we've paid particular attention to how well the smartphone and tablet clients work.

"Maintaining control of a PC from your handheld device is surprisingly easy."

IDEA
strategy
Idea
IDEA
business

FREE | TINYURL.COM/DY8UFZ8

Chrome Remote Desktop

Simple, free and works fantastically.

Google's remote access solution is about as effortless as they come. With the Chrome Remote Desktop extension installed on your server computer's Chrome browser, you'll be able to assume control of it from any other Chrome Browser that you logged into (your connections are tied to your Google account) or from the Chrome Remote Desktop Android or iOS app. Security is provided by a six-digit PIN, so you don't have to worry about people opening your browsing and having full access to your files.

Controlling Chrome Remote Desktop from a smart device is a breeze, with a responsive app that features two control methods – Touch Mode gives you touchscreen control of your desktop, while Trackpad Mode gives you a mouse pointer for more accuracy. A touch keyboard can be brought up at any time, but it lacks most function keys. Pinch, zoom and scroll functions are also available, but it's not ideal for multi-monitor setups. Still, it's the easiest and cheapest remote access solution out there.

Verdict

Not as feature-packed as some paid options, but it works great and is the most hassle-free remote access software you're likely to find.

★★★★☆

US$19.95 PER MONTH
WWW.GOTOMYPC.COM/

GoToMyPC

Two hundred and forty bucks a year? Fuggedaboutit.

GoToMyPC does everything you'd expect a remote access program to do, if not spectacularly well. Setup is a piece of cake, you just have to download and run GoToMyPC's software on your server computer, create a login and then connect to it from your iOS or Android device using the slick GoToMyPC app.

While your desktop display is crisp and clear, there is noticeable lag between actions on your server and remote computers. Mouse controls are also awkward, as you have to tap and drag around a transparent mouse icon to move your cursor. As the pointer rests above the mouse icon, we had a tough time trying to reach anything on the Windows taskbar.

Still, you can use GoToMyPC to transfer files and print remotely, which works well, but we just can't get over how expensive it is US$19.95 a month (almost US$240 a year) is a ridiculous price to pay for an experience that isn't all that special.

Verdict

GoToMyPC gets the job done, but is flawed and hugely expensive.

★★½☆☆

US$99 PER YEAR
TINYURL.COM/BQVLB

LogMeIn

Works well, but way too expensive.

LogMeIn is a premium remote access application that runs smooth, looks great and is easy to use, however all of this comes at a significant cost, especially when compared to most other remote desktop services.

Setting up LogMeIn is incredibly easy. Simply create an account, download and install the LogMeIn software client, and add the computer you're on to LogMeIn's list. From here, you only have to download and login to LogMeIn's accompanying iOS or Android app to find your connections there waiting for you.

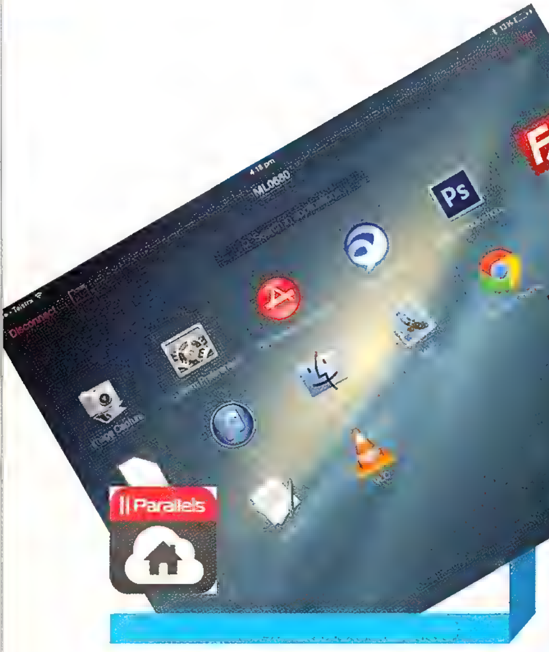
Your desktop will be replicated with total clarity, with multiple resolution and colour options available if you want to simplify things. Mouse movements are smooth and instant, and you have the option of running a diagnostic toolkit on remote machines.

While LogMeIn is impressive in every respect, casual users will want to steer clear of its exorbitant prices, starting at US$99 a year for two measly devices, and up to US$449 a year for ten devices.

Verdict

LogMeIn is great, but hard to recommend at those prices though.

★★★☆☆



$19.99 A YEAR
TINYURL.COM/PTPA8SH

Parallels Access

Feature packed with a great interface.

Unlike most remote access apps, Parallels Access attempts something different by presenting the user with a unique, touch-based version of their computer. Your apps are shown as icons, like on OS X's Launchpad or a smart device home screen. Opening an app presents it in fullscreen mode. You can swipe between open apps by tapping on the window icon on the right side of the screen.

While this is a novel approach, all of your apps aren't immediately accessible and it'll require some searching around to find the rest. Thankfully, a more traditional experience can be acquired by adjusting the settings.

When Parallels Access is actually replicating your desktop, it works very well. Touch and mouse pointer modes are available (with special function keys and right and left click buttons), and you can still cycle through apps easily if you want to avoid manually moving windows around.

Parallels Access is smooth and speedy, though you can get a similar experience elsewhere for free.

Verdict

Very good, but other free options are just as good.

★★★½

apc RECOMMENDS

FREE FOR PRIVATE USE
WWW.REALVNC.COM/

RealVNC

Great remote access for advanced users.

RealVNC has a suite of features that exceeds most other clients of this type, though newcomers will find that there's a steep learning curve. First of all, you'll likely need a bit of knowledge regarding firewalls and ports and encrypted connections in order to set it up. Our initial attempt to install the RealVNC client on a Mac ran into some hurdles regarding occupied ports which took some time to address, though the Windows installation ran much smoother.

Once everything is up and running however, RealVNC works remarkably well. Actions are translated instantly between remote and server, with differences between the two only measurable in nanoseconds. Mouse control is fast and accurate, scaling could be smoother but works well nonetheless, and its keyboard is the most full-functioned we've come across.

RealVNC does everything well, but we'd only recommend it to people with intermediate computer skills. Clients are available for Windows, Mac OS X and Linux computers.

Verdict

Perfect for administrators and people who know their way around computer settings, but novices should find something else.

★★★★

apc HOT PRODUCT

FREE
TINYURL.COM/7YAELU5

TeamViewer: Remote Control

We can see why this service is so well-regarded.

With over two hundred million users, TeamViewer is arguably the most popular remote access service in the world – and that many people can't be wrong. Featuring a range of advanced features, TeamViewer lets you connect to multiple computers and even host meetings remotely.

Admittedly, TeamViewer's app didn't leave an amazing first impression with its default touch settings, however after some tinkering with input methods and screen res, the app worked fantastically. Its keyboard also provides access to function keys on top of the screen.

You can opt to prioritize speed over quality, however the app is remarkably fast on either setting – lag feels almost non-existent. While picture quality is quite fuzzy, the response time makes that sacrifice acceptable.

There's a free version for personal use that works well, though you'll have to get used to annoying pop-up messages thanking you for being "fair". However, if you're a bit of a big-shot, you can opt to purchase a business or corporate package instead. ■

Verdict

Advanced features and quick response time makes TeamViewer a winner.

★★★★½

REVIVE YOUR OLD TECH!

FIND PRACTICAL NEW USES FOR YOUR OLD SMARTPHONE, TABLET, PC, LAPTOP, ROUTER, MONITOR + MORE!

46 REVIVE YOUR SMARTPHONE OR TABLET
46 Make a desktop PC (Android)
47 Make a portable DVB-T TV (Android/iOS)
48 Make a handheld Bluetooth music jukebox (Android/iOS)
49 Make a Netflix smart TV with mobile remote (Android/iOS)
50 Make a digital audio workstation (Android)
52 Make an emergency wireless NAS (Android)
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56 REVIVE YOUR PC OR LAPTOP
56 Make a Steam Box
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60 Contribute with compute
61 Give it away

62 RESURRECT A ROUTER
Nathan Taylor creates a secure-access internet router.

63 RE-USE YOUR OLD MONITOR
Follow Nathan Taylor's advice to create a digital picture and media frame.

64 RESPONSIBLY RECYCLE YOUR OLD TECH
If it's finally time to let your old tech go, use it to earn cash, contribute to charity or recycle responsible.

Make a desktop PC

Turn your old tablet or smartphone into an Android-powered desktop PC. Darren Yates explains how.

What you'll need:

- Android smartphone or tablet with at least Android 4.2/Jelly Bean OS
- Google Chromecast or Netgear PTV3000 Miracast receiver
- USB hub
- USB OTG cable or MHL-to-HDMI cable
- Total cost: approx. $10 to $60
- Total time to complete: about 30 minutes

If every smartphone and tablet is a mobile computer, can you use one in place of a desktop PC? It sounds daft, but your Android device can actually form the basis of a simple but effective PC – and depending on the hardware you have, there may be multiples way to do it.

DEVICES WITH BLUETOOTH

The key external functions you need are clearly keyboard, mouse and monitor – everything else can be handled by the Android device. Starting with user input, a Bluetooth keyboard/mouse combo would be ideal, provided you have Bluetooth available. This also allows you the cheapest option for connecting a monitor. Many phones starting with the Galaxy S2 support MHL (mobile high-definition link) video for connecting straight to the HDMI port on your TV or monitor. The same port also supports USB-OTG, but it only allows one connection type at a time, even if you use a splitter cable or hub, meaning if you use MHL/HDMI, you can't use USB-OTG and vice versa. MHL-to-HDMI cables are available online for under $10.

DEVICES WITHOUT BLUETOOTH

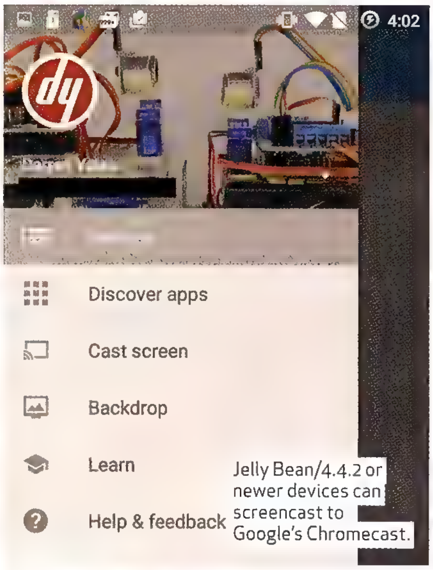
But if your Android device doesn't have Bluetooth, all's not lost. You can try a wireless keyboard/mouse combo with the USB receiver module connected to the Android device's USB-OTG port (you'll find USB-OTG cables online for about $5). Alternatively, connect a USB wired keyboard and mouse to a USB hub and plug that into your device's USB-OTG port.

However, either option means you can no longer use MHL to get video output – but you still may have alternatives. First, if your device is running at least Android 4.2/Jelly Bean (or Jelly Bean/4.1 on a Samsung Galaxy S3), try the AllShare Cast/Miracast function to cast the screen to a Netgear PTV3000 Miracast (or similar) receiver. We've had this working on a Galaxy S3 using Samsung's 4.1.2/Jelly Bean stock ROM and the PTV3000, but Miracast can be temperamental with some device/receiver combinations, so research your Android device compatibility before you buy.

The other option if you have at least KitKat/4.4.2 is to cast the screen to a Chromecast dongle. Screencasting is a beta feature in Chromecast, similar to Miracast/wireless HDMI, but uses your Wi-Fi network instead of P2P Wi-Fi. In both cases, we've obtained best results using an official/stock ROM on the Android device – custom ROMs without proper support often produce noticeable lag. In the end, your mileage may vary, depending on the hardware you have at hand.

NO POWER OVER USB-OTG

As we've mentioned elsewhere, the one drawback with USB-OTG is that it doesn't support charging your Android device, even if you're connected to a powered USB hub. But if you can use a Bluetooth keyboard/mouse and Miracast or Chromecast screencasting – essentially, a totally wireless setup – you'll have your Android device's USB port free to run the standard charge cable, which would give you the overall best setup possible. If your device has a separate power connection, using USB-OTG becomes less of an issue and more connection combinations are possible, but as always, try before you buy.



Jelly Bean/4.4.2 or newer devices can screencast to Google's Chromecast.

MHL adapters can connect supported phones to your TV's HDMI port.

Grab a USB-OTG adapter cable to hook the USB hub to your Android device.

NETGEAR
HDMI
RESET
POWER

Netgear's PTV3000 Miracast box delivers wireless HDMI to supported devices.

Make a portable digital TV

Turn your old Android or iOS device into a compact portable digital free-to-air TV. Darren Yates reveals how you do it.

What you'll need:

ANDROID
- Android smartphone/tablet with at least Android 4.0.3/ICS and 800MHz CPU
- DVB-T tuner for Android devices
- Corresponding software from Google Play
- Total cost: $25 to $50
- Time to complete: 15 minutes

iOS
- Apple iPad, iPhone 3GS or newer (iPad 4/iPhone 5 or newer for iDTV)
- Tivizen Nano (or iDTV Mobile Lightning DVB-T tuner)
- Corresponding software from Apple App Store
- Total cost: $70 to $150
- Time to complete: 15 minutes

Streaming movies online via Netflix is easy enough to do on mobile devices, but what about watching live free-to-air TV? With new digital TV dongles now available, that old tablet or phone might just have found a new role. What's more, it's internet bandwidth-free.

MOBILE DVB-T TUNERS

USB DVB-T tuners for PCs have been around for years, but very few seem to work on mobile devices. However over the last year, new compact options have begun appearing in Australia and online that are designed for Android and iOS devices.

Right now, Taiwanese brand D-Link has a DSM-T100 portable digital TV receiver available in Australia (similar to Geniatech's PT115). According to the company, you need at least Android 4.2/Jelly Bean OS and a minimum of either an 800MHz single-core Cortex A8 CPU to view standard-definition (SD) TV or a dual-core Cortex A9-grade device to watch HDTV channels. It supports MPEG-2 and MPEG-4 transmissions, so it shouldn't reach its use-by date any time soon. You can buy it online from the D-Link shop (**dlink.com.au**) and other retailers for $49.95 plus shipping. Make sure you also download the PadTV viewer app from the website or grab it from Google Play.

CHEAPER ALTERNATIVES

However, it's not the only option. You'll find a number of alternatives on eBay, starting from just US$18 including shipping. The main difference is that some cheaper models appear not to include MPEG-4 support – that's not an issue for the moment as all current Australian DVB-T transmissions are MPEG-2 only. But if the federal government switches to MPEG-4 in the future, MPEG-2 dongles become pretty ordinary paperweights. However, these cheaper options also only claim to need Android 4.0.3/ICS or newer, which opens up many more devices.

IOS OPTIONS

If you're after something offering iOS support, iCube's Tivizen Nano VTV-T12 (**en.tivizen.com/nano**) is an option. Available in Australia for around $150, this clever DVB-T tuner looks and acts like a portable Wi-Fi hotspot, but instead of streaming internet, it streams free-to-air TV. It works with both Android (Honeycomb/3.1 or newer) and iOS (iPhone 3GS/iPad or newer) devices. EyeTV Wireless from Elgato does much the same thing and also supports Android and iOS – you'll find it for around the $130 mark locally.

If you have a late-model iOS device with the Lightning port, there's also the tiny iDTV Mobile Lightning digital TV tuner available online in Australia for $70 that plugs straight into the port, giving you a more self-contained solution.

And of course, don't forget the corresponding apps from the App Store to drive them.

DVB-T TV SIGNAL STRENGTH

But something to keep in mind, which ever model you purchase, is don't assume the supplied loop or stick antenna will always deliver sufficient signal strength, particularly if you're in a fringe reception area. You may need an MCX to PAL TV antenna adapter to plug in a proper TV antenna. These adapters sell for US$1 on eBay – check your tuner before you buy.

You may need an MCX-to-PAL TV antenna adapter cable for fringe locations.

You'll find DVB-T tuners on eBay starting at US$18 including shipping.

iCube's Tivizen Nano streams DVB-T TV via Wi-Fi to iOS/Android devices.

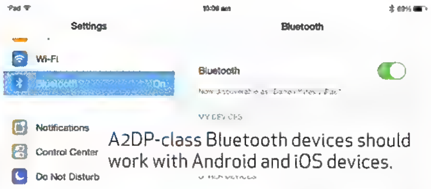
D-Link's DSM-T100 DVB-T tuner for Android devices sells for $50 online.

Make a hand-held Bluetooth music jukebox

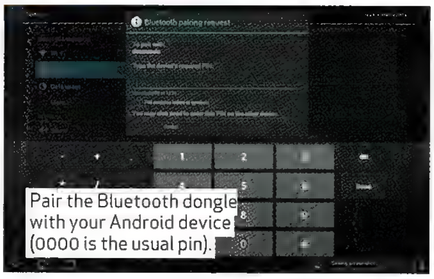
Run the music for your next party from a hand-held jukebox. Darren Yates shows you how.

What you'll need:

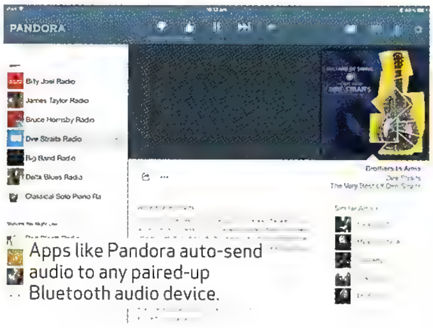
- Android device with Android 2.3/Gingerbread or later, Bluetooth
- iOS device (iPad or iPhone)
- Bluetooth audio receiver
- Total cost: $5 to $50
- Total time to complete: 10 minutes



A2DP-class Bluetooth devices should work with Android and iOS devices.



Pair the Bluetooth dongle with your Android device (0000 is the usual pin).



Apps like Pandora auto-send audio to any paired-up Bluetooth audio device.

Don't hire a DJ for your next party – for less than $5, you can turn your home-theatre or hi-fi system into the ultimate jukebox, all driven from your old Bluetooth-enabled smartphone or tablet.

BLUETOOTH AUDIO

Bluetooth is a low-power peer-to-peer (P2P) wireless networking standard commonly used to connect headsets and keyboards to devices and more recently, thanks to A2DP (Advanced Audio Distribution Profile), it's spawned the proliferation of portable Bluetooth speakers. But for many of these speakers, the problems can be a lack of output power and average audio quality, particularly insufficient or soggy bass. Throw in prices heading well north of $100 and they're hard to choose.

But if you already have a decent audio system, all you need is a Bluetooth audio adapter/receiver, which grabs the Bluetooth signal transmitted by your phone or tablet, extracts the audio from it and gives you a 3.5mm stereo socket output you can connect straight to your audio system.

HOW IT WORKS

These Bluetooth dongles look like USB flash drives, but instead of connecting into your PC, you just plug it into your phone's USB power adapter and connect a 3.5mm stereo cable into the back-end of the dongle. The other end of the cable goes to your audio system.

Next, you power up your mobile device, make sure Bluetooth is switched on, go to Settings/Bluetooth and connect or 'pair' it to your Bluetooth receiver. From here, fire up your favourite audio player on your device and when you choose to play a track for the first time, it'll either ask if you wish to transmit the audio via Bluetooth or just do it automatically. Turn up the volume on your sound system and your device and enjoy the music.

AVAILABLE OPTIONS

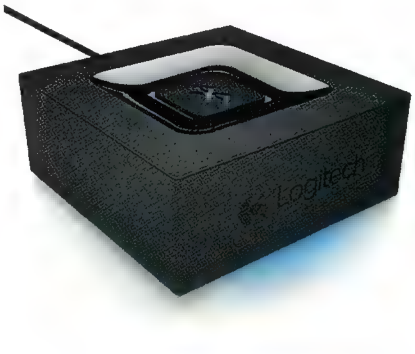
Bluetooth audio receivers/adapters are available from major retailers in Australia starting from around $30. However, the option described above we picked up from eBay for $4 including shipping. We had no trouble pairing it to any of our Android Bluetooth-ready or iOS devices and the audio quality was surprisingly good. If you're a connoisseur of valve amps and Origin Live turntables, you might turn your nose up at it, but most people won't tell the difference.

But the real benefit is, load up your device with your favourite music and provided you stay within 10 to 20 metres of your Bluetooth receiver, you can dial up the music with no cables attached or any gizmo hanging off your phone or tablet.

FREE MUSIC

Don't have a great music collection? No worries – download Pandora, SoundCloud or Spotify (among other alternatives) from Google Play or Apple App Store and stream free online music through your Bluetooth audio receiver. What's great about most Bluetooth audio options is that they'll even work with older devices going back to Android 2.3/Gingerbread and iOS 5.0. So, if you have an old HTC Wildfire S or iPhone 3GS phone doing not very much, pull it out for your next party and use it as your communal wireless music jukebox.

Budget Bluetooth audio dongles go for $5 on eBay, including shipping.



Make a Netflix smart TV with mobile remote

Use your Android or iOS device and make your own smart TV. **Darren Yates** explains how it works.

What you'll need:

- Android device with Android 4.0.3/ICS or later, or
- Apple iOS 7.0 or newer device
- Google Chromecast dongle
- Home broadband with Wi-Fi
- Total cost: about $50
- Time to complete: 30 minutes

Australia is currently in the midst of a boom in 'video on demand' (VOD) streaming with Stan, Netflix, Presto and Quickflix all offering movies and TV shows for around $10 a month. If your TV doesn't have the built-in tech to deliver those services, you don't need a new smart TV – you can make your own.

HOW IT WORKS

Smart TVs are essentially ordinary flatscreen TVs with a tablet-grade processor bolted on providing the 'smart' tech. In terms of VOD streaming, you can turn any HDMI-ready TV (and almost any HDMI-ready monitor) into a smart one with a $49 Google Chromecast dongle.

We've looked at Chromecast previously – we've even shown you how to hack it – but combined with almost any Android and late-model iOS devices, Chromecast can turn your TV into a wireless streamer able to play Netflix and other VOD streaming services.

Chromecast contains all the hardware required to stream, decode and output those VOD streams – a single-core Marvell SoC CPU with 802.11n Wi-Fi and an HDMI output for up to 1080p (full HD) content – but the key is the Chromecast app.

The app only requires an Android device with Gingerbread/2.3 to become a Chromecast remote control. But minimum OS requirements for VOD streaming apps vary – for example, you'll need at least ICS/4.0.3 to use the Android apps from Netflix and ABC iView (at time of writing, the only local free-to-air broadcaster with Chromecast support), while streaming Stan requires Jelly Bean/4.2. For iOS devices, you need at least iOS 7.0 across the board.

But Stan is the man with the plan at time of writing – sign up for a 30-day free trial and you could have a Chromecast dongle delivered for $39 from Dick Smith online, $10 off the normal price.

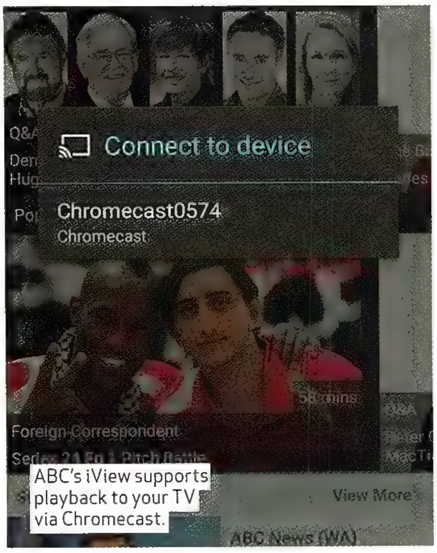
ANY TABLET AS A REMOTE?

What's clever about the Chromecast system is its reliance on only Wi-Fi for control – it means you don't need recent additions such as Miracast or MHL in your device. You don't even need Bluetooth. As long as you have working Wi-Fi, the minimum OS requirements and your preferred Chromecast-ready VOD app, you should be good to go. The key to Chromecast is that it is its own ecosystem, with specific Chromecast versions of VOD apps. For example, when you select a movie to watch via Chromecast on the Netflix app, you're actually telling the dongle to load the Netflix Chromecast app, which then tracks down your video and plays it. Your mobile device then uses the Wi-Fi connection over your home network to control Chromecast playback, volume and time-position.

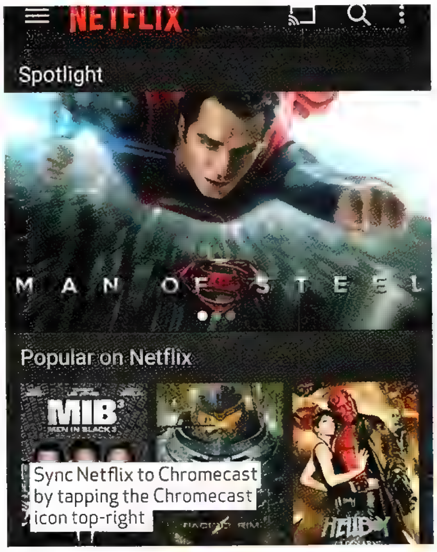
Google's Chromecast is the easiest way to turn any TV into a smart TV.

CHROMECAST ALTERNATIVES

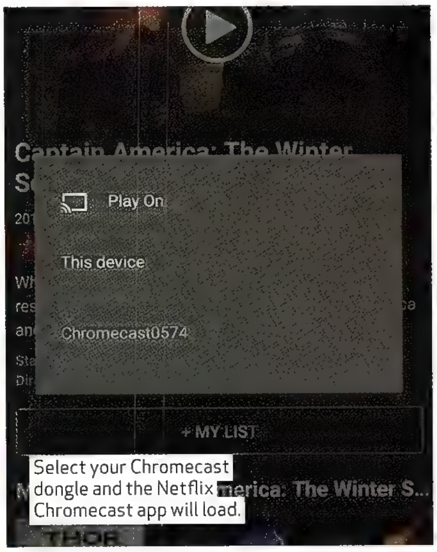
If you'd rather watch your own movie library instead, you can stream your content straight to your device using any number of apps, but we'd probably lean towards Plex as the most polished – grab the free Plex server for your PC and purchase the Plex app from Google Play or the App Store. But Android users also can't go far wrong using just ES File Explorer and MX Player, free from Google Play – ES File Explorer will see any shared folders available on your network and we still haven't found a file format MX Player can't play.



ABC's iView supports playback to your TV via Chromecast.



Sync Netflix to Chromecast by tapping the Chromecast icon top-right



Select your Chromecast dongle and the Netflix Chromecast app will load.

Make a digital audio workstation

Your Android device could do much better than a single microphone. **Darren Yates** uncovers how to turn it into a digital audio workstation.

What you'll need:

- Android tablet or smartphone with Honeycomb/3.1 or later, 800 x 480-pixel resolution minimum, USB host or OTG support
- USB Audio Recorder PRO app from Google Play
- Audio Evolution Mobile DAW from Google Play
- USB sound card supporting USB Audio spec 1.0 or 2.0.
- USB-OTG cable (as necessary)
- Total cost: up to $70
- Total time to complete: 30 minutes

Android tablets and smartphones are better known for playing audio than recording it, but combine the right hardware with dedicated apps from Google Play and you can turn your tablet or phone into a multi-channel digital audio workstation.

HOW IT WORKS

To put it bluntly, most Android devices have pretty ordinary built-in audio recording capabilities – mostly because, apart from phone calls, they're not designed to do anything more. In fact, that's provided space for the booming digital audio recorder market powered by the likes of Zoom and Tascam. At best, most Android tablets and phones give you a single-channel 16-bit/48kHz ADC and a tiny MEMS (micro-electromechanical system) microphone jammed somewhere into the chassis.

Google has begun addressing this issue by incorporating native support for USB Audio devices into the latest Lollipop/5.0 version of Android. Unfortunately, that's not going to do much for older Android devices, but thankfully, there is a solution.

The team at eXtream Software Development didn't bother to wait for Google to incorporate USB audio support into Android – they added it themselves to their USB Audio Recorder PRO app. It means using this app, you can connect a supported external USB sound card into your device with Android 3.1/Honeycomb or newer and record high-quality stereo audio, bypassing the device's internal audio system.

USB AUDIO 1.0/2.0 SPEC

For this to work, your Android device must have a USB host or USB-OTG port. You also need an external USB sound box that supports the USB Audio 1.0 or 2.0 class specification – essentially, it has to be plug-n-play without installing separate driver software.

To test what this meant in practice, we pulled out an Acer Iconia Tab A200 tablet plus a $30 run-out KitKat/4.4 tablet bought from the local Coles supermarket, plugging in a $2 USB sound adapter from eBay plus a $40 Creative Labs Play dongle and both worked first-go. We then dug up a 15-year-old Creative Sound Blaster Extigy USB sound card, plugged it in, had all channels recognised and patched into the app mixer and happily began recording via the stereo line-level input feed. However, it would occasionally set the sample rate incorrectly, giving high-pitched recordings. Finally, we tested a slightly newer Creative Audigy 2 NX, which worked perfectly, although it lacked master input faders on the app's mixer page, meaning right and left-channels had to be adjusted individually, rather than as a pair. This was a pity, since the Extigy offered master input faders.

OTHER OPTIONS

But if you don't have one of these cards on hand, you'll find low-cost options on eBay for under $10 to try out. Unfortunately, the one we ordered hadn't arrived before our deadline, but the eXtream team has tested the app with a long list of USB sound modules, including Lexicon's Alpha/Lambda/Omega series, M-Audio Fast Track series and even the Zoom H2/H4 digital audio recorders. Get the USB device support list from the eXtream web site (**tinyurl.com/p8nxqyr**), but don't assume it's exhaustive.

USB OTG SUPPORT

If you're fortunate enough to own a tablet with a built-in Type-A USB port such as the Iconia Tab A200, you should be home and hosed. But for devices with only a micro-USB port, you need to ensure your device supports USB-OTG. Android officially began supporting USB-OTG from Ice Cream Sandwich (ICS)/4.0, so if you have an older tablet, we can't guarantee it'll work. That said, we'd still try it anyway – you might get lucky. However, for ICS-native and newer devices, USB-OTG support should be baked in.

WIRING IT UP

Putting the whole thing together is pretty simple – you plug your audio devices into your USB sound module, plug the module's USB cable into the USB OTG cable and that into your Android device (or just straight into the Type-A host port). Just be sure to power up your audio chain before launching the USB Audio Recorder software – the app checks for USB devices only once at launch and if it's not recognised, it won't work.

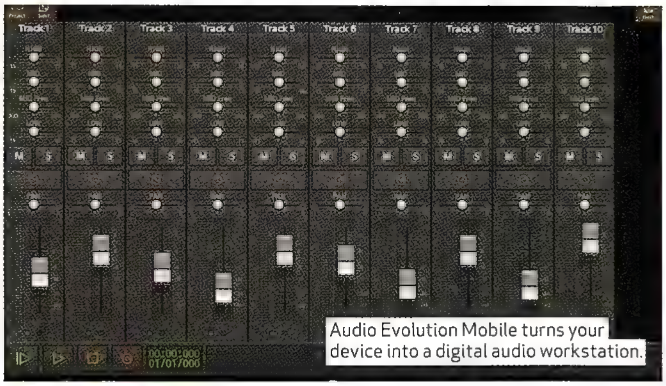
If your sound card supports both bus-powering and external power, use external. The fact it has an external power option means it'll likely draw reasonable power from the USB-OTG port, so power it externally and save your device's battery.

ALPHA
Instrument
Chan 1/Inst
Chan 2/Mic
Monitor Mix
Output Level

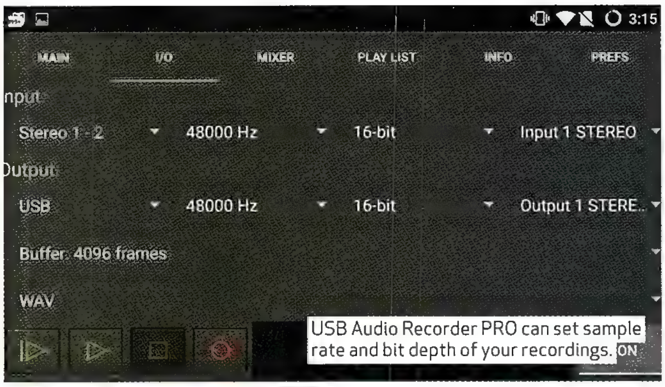
The Lexicon Alpha is supported by the USB Audio Recorder Pro app.

OPTICAL OUT
SPDIF OUT
C/SUB
REAR
FRONT
USB

Creative's Audigy 2 NX also works with USB Audio Recorder Pro.


Track 1
Track 2
Track 3
Track 4
Track 5
Track 6
Track 7
Track 8
Track 9
Track 10
00:00:000
01/01/000

Audio Evolution Mobile turns your device into a digital audio workstation.


3:15
MAIN
I/O
MIXER
PLAY LIST
INFO
PREFS
ON

Input

Stereo 1 - 2 · 48000 Hz · 16-bit · Input 1 STEREO

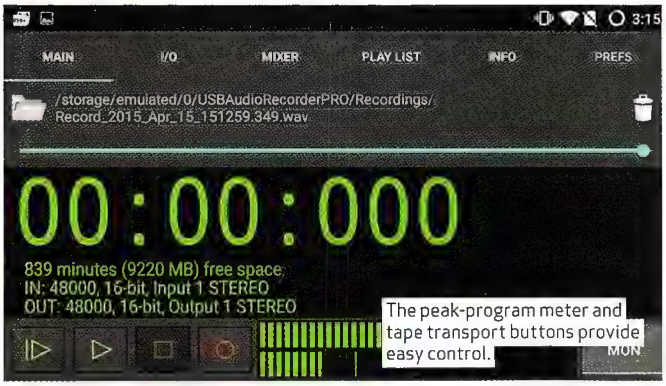
Output

USB · 48000 Hz · 16-bit · Output 1 STERE..

Buffer: 4096 frames

WAV

USB Audio Recorder PRO can set sample rate and bit depth of your recordings.

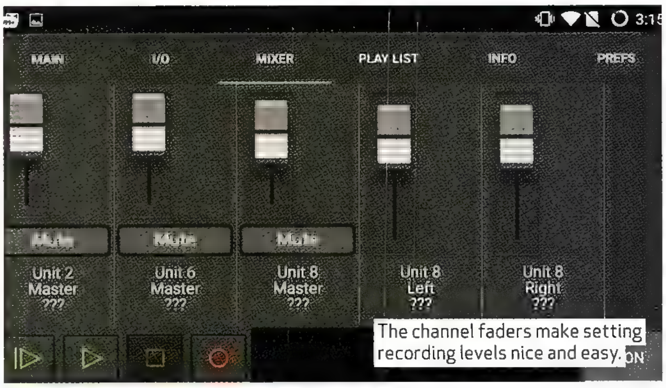

3:15
MAIN
I/O
MIXER
PLAY LIST
INFO
PREFS
MON

/storage/emulated/0/USBAudioRecorderPRO/Recordings/
Record_2015_Apr_15_151259.349.wav

00:00:000

839 minutes (9220 MB) free space
IN: 48000, 16-bit, Input 1 STEREO
OUT: 48000, 16-bit, Output 1 STEREO

The peak-program meter and tape transport buttons provide easy control.


3:15
MAIN
I/O
MIXER
PLAY LIST
INFO
PREFS
Mute
Mute
Mute
Unit 2 Master ???
Unit 6 Master ???
Unit 8 Master ???
Unit 8 Left ???
Unit 8 Right ???
ON

The channel faders make setting recording levels nice and easy.

The app will cost you about $7.50, but there's also a free demo test version. Given what it can do (up to 192kHz/24-bit stereo recording if your hardware supports it), we found it money well spent.

DIGITAL AUDIO WORKSTATION APP

For multi-track audio, grab the Audio Evolution Mobile DAW app. It, too, will cost you about $7.50 and there's a demo/trial version on Google Play to give you a basic run-through without save function. You will need in-app purchases to grab USB MIDI and audio hardware support, or you can just purchase USB Audio Recorder PRO. We tested it with a generic Windows XP-era USB MIDI box, which the app recognised and had working, straight off the bat.

But the major issue you'll likely face with any DAW solution is latency, the delay time it takes for audio to be recorded onto a track as well as MIDI signals to register. If the latency is too high, you can end up with your tracks out-of-sync. Audio Evolution Mobile uses its own latency minimising tricks, including direct-access to audio hardware and bypassing the Android audio layer. There are extra tweak options in the Settings menu as well.

YOUR MILEAGE MAY VARY

As for overall audio recording quality, it all comes down to your USB audio module — the Android device is really only performing as a digital data stream recorder. But in the end, we can't guarantee you'll have a seamless experience as it will obviously depend on the mix of hardware you have. But even with the odd hiccup, our experience of having Windows XP-era sound gear working with Android devices not even dreamt of when that gear was made is seriously impressive.

Yes, you can already do all of this with an iPad and GarageBand — but now, you may not have to.

Like most things, having USB-OTG support is crucial for USB audio to work.

CREATIVE
Sound Blaster
Extigy
LINE IN
MIC IN
HEADPHONES
MASTER
CMSS

Creative's Sound Blaster Extigy should work with USB Audio Recorder PRO.

Make an emergency wireless NAS

Use an Android smartphone or tablet to power your own low-cost network attached storage. **Darren Yates** steps you through how it's done.

What you'll need:

- Android phone or tablet with at least Ice Cream Sandwich/4.0, USB-OTG or Type-A host port, root access, power separate from USB port preferable
- 16-64GB USB flash drive
- SambaDroid app from Google Play
- USB OTG Helper app from Google Play
- USB OTG cable (where necessary)
- Total cost: up to $50
- Total time to complete: 20 minutes

Having access to shared storage is almost a given these days, but in an emergency, you can make a portable network-attached storage (NAS) setup using an old Android tablet or smartphone.

HOW IT WORKS

As we've noted elsewhere, Android first supported USB storage from Ice Cream Sandwich/4.0 and while the odd tablet will include a Type-A host port, most devices rely on microUSB ports instead, requiring a USB-OTG cable. Yet with just a couple of apps, you can turn your Android device into a wireless NAS setup that even supports NTFS partitions.

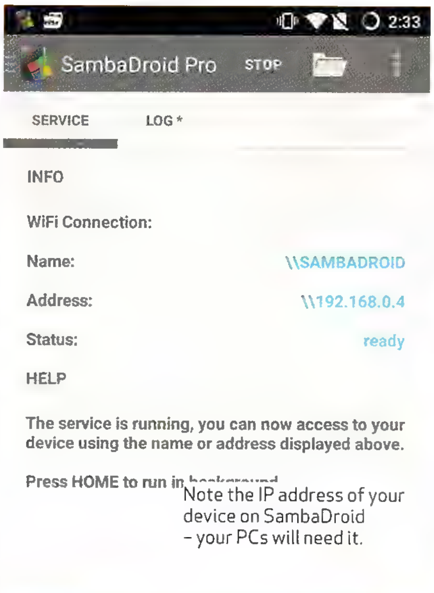
While Android doesn't natively support the NTFS file system, USB OTG Helper from Google Play fixes that and SambaDroid provides the SMB/CIFS support to share that storage over your home network.

Both apps need root-access, but be warned – rooting your device will void its warranty and may cause damage in the rare event something goes wrong.

MOUNTING AND SHARING

Plug the flash drive into the USB-OTG cable and into your Android device. USB-OTG Helper should auto-fire when it recognises the USB-OTG port and finds the drive, but we've seen on some devices the app may not be necessary. Next, launch SambaDroid and go through the intro. Once ready, it'll self-launch its server function, attaching itself to your Wi-Fi connection and your home network. To share the newly-mounted drive partition, press the folder icon at top-right and on the new 'Manage Shares' screen, press the '+' button and locate your drive (try the /mnt path). Give the drive a name, press the tick button and you're done.

Go to your networked PC, launch Windows Explorer and click in the address bar, typing the IP address listed in SambaDroid ('\\192.168.0.4' in our example). All going well, you should see the drive partition listed and you're good to go.



INFO

WiFi Connection:

Name: \\SAMBADROID

Address: \\192.168.0.4

Status: ready

HELP

The service is running, you can now access to your device using the name or address displayed above.

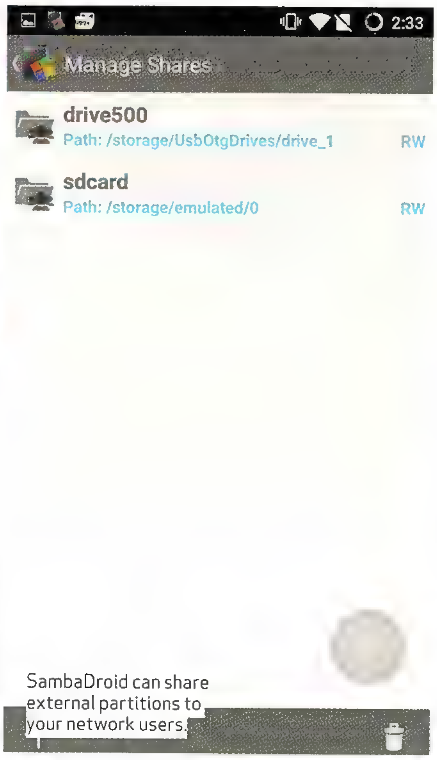
Press HOME to run in

Note the IP address of your device on SambaDroid – your PCs will need it.

USING A PORTABLE HARD DRIVE?

Technically, it is possible to use a portable hard drive via a powered USB hub and plug that into your Android device via USB-OTG. We even tried it successfully. But there are pitfalls. First up, if the voltage of the powered hub doesn't match the voltage supplied by the Android device on the USB-OTG port, you'll have a voltage differential, resulting in current flow out of the USB-OTG port, which ultimately has to come from the battery. USB-OTG doesn't support device charging, so even though you're connected to a powered hub, not only will the battery not charge, the voltage differential could mean it discharges faster than normal. We tested this using a USB power monitor – our test tablet delivered 5.37V to the USB-OTG port (above USB spec), while the powered hub had 5.12V. Plugging the hub into the USB-OTG port created a data connection to the drive, but also resulted in a 0.2-amp current flow out of the OTG port.

If you're going to try a portable drive, and we don't recommend it, you need an Android device with a separate power input to keep it going.

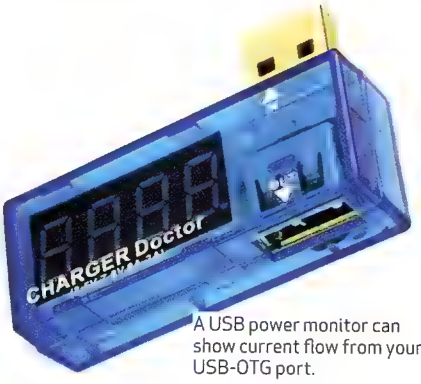


drive500
Path: /storage/UsbOtgDrives/drive_1 RW

sdcard
Path: /storage/emulated/0 RW

SambaDroid can share external partitions to your network users.

A sizeable USB flash drive should provide enough emergency share storage.



A USB power monitor can show current flow from your USB-OTG port.

Make a home Wi-Fi video security system

Turn your old smartphone and tablet into a simple wireless home security system. Darren Yates shows how it works.

What you'll need:

- Android smartphone and tablet with at least Gingerbread/2.3 OS
- IP Webcam app from Google Play
- tinyCam Monitor FREE app from Google Play
- Total cost: free
- Total time to complete: approx. 15 minutes.

Internet-protocol (IP) security cameras are big business, but if you have old Android phones or tablets, you can set up a wireless video security system for free.

HOW IT WORKS

Android devices have a common minimum-level features set – 600MHz CPU, 2MP camera sensor and 802.11g Wi-Fi. It's enough to turn any tablet or smartphone with Gingerbread/2.3 (at least) into an IP webcam with the free IP Webcam app from Google Play.

We tested this using an ageing Wildfire S smartphone with Gingerbread/2.3.5 OS. The Wildfire S's main drawback is its lack of internal storage, which may require you ditching existing apps to get the IP Webcam app on-board. Once installed however, you can choose the default options, scroll down to tick 'Stream on device boot', tap 'Start Server' and you should see video, along with the IP address of your device.

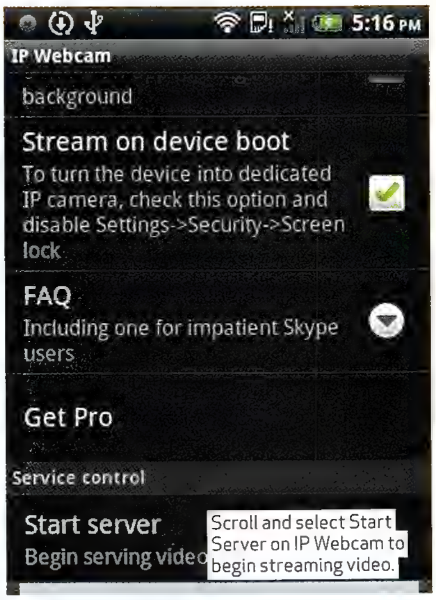
One tip here – the older your Android device, the lower the video resolution you should select to maintain adequate frame rate (a 600MHz CPU will give you around 10fps at best), but that's up to you. Press the search button on your phone to set the focus.

SETTINGS OPTIONS

IP Webcam can also trigger on sound using the built-in mic or use motion detection via the camera itself. Choose the detection sensitivity you want and whether to record video to on-board storage – this allows you to use IP Webcam as a standalone recorder. But to get started, the default settings should be fine. However, using Wi-Fi and video capture will be hard on the battery, so it'll be worthwhile to keep the AC power adapter handy.

SETTING UP TINYCAM MONITOR

On your other Android phone or tablet, install tinyCam Monitor FREE from Google Play. The app says OS support 'varies with device', but we were able to install it on Android 4.0 devices, although we tested it on a Galaxy S3 phone running Lollipop/5.0.2.



IP Webcam

background

Stream on device boot
To turn the device into dedicated IP camera, check this option and disable Settings->Security->Screen lock ☑

FAQ
Including one for impatient Skype users

Get Pro

Service control

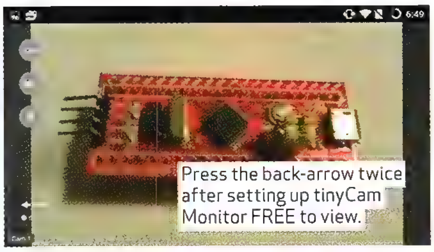
Start server
Begin serving video

Scroll and select Start Server on IP Webcam to begin streaming video.

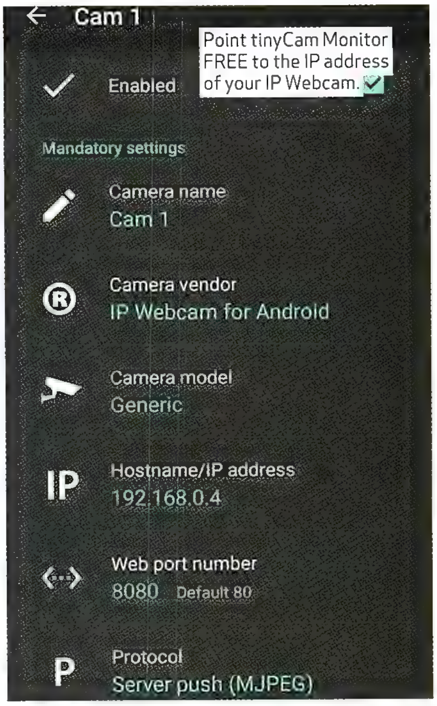
Once the app is installed, launch it. When you've gone past the main intro, press the '+' icon to add a new webcam. If you don't see the icon, choose 'Manage cameras' in the menu. Look for 'Cam 1', choose the menu button next to it on the right and select Edit. Next, scroll down and set the 'Camera vendor' entry to 'IP Webcam for Android' and the IP address to the one in the IP Webcam video window (in our example, the address was 192.168.0.4).

Tick the Enabled checkbox, press the back arrow at top-left twice and you should now see video being streamed from your other device.

The tinyCam Monitor FREE app can provide a 2x2-square of up to four IP webcams simultaneously (Wi-Fi bandwidth notwithstanding), but even more useful is the fact it can work with a range of genuine IP webcams, not just old Android devices (set the Camera vendor as appropriate), turning your tablet into a multi-camera monitor. For a free app, tinyCam Monitor FREE is one of the best apps of its type we've seen.



Press the back-arrow twice after setting up tinyCam Monitor FREE to view.



Cam 1

✓ Enabled

Mandatory settings

Camera name: Cam 1

Camera vendor: IP Webcam for Android

Camera model: Generic

Hostname/IP address: 192.168.0.4

Web port number: 8080 Default 80

Protocol: Server push (MJPEG)

Point tinyCam Monitor FREE to the IP address of your IP Webcam.

htc
10 08
Sydney
24°

The Wildfire S' RAM shortage may require losing apps to install IP Webcam.

Make an electronics test lab

Electronic test equipment can costs many hundreds of dollars. Darren Yates shows how your old Android or iOS device can get you started for next to nothing.

The maker community is bringing electrical engineering back into vogue, but having the test gear can run into big money. Before you unload your wallet, your old phone or tablet can help you learn the basics – and maybe even save you money.

HOW IT WORKS

When building your own tech gear, having the right test equipment is like having the right debugging tools for coding your own apps – it can show what's going wrong and help point you in the right direction. A digital multimeter (DMM) is a must-have for any hobby electronics work, but three other pieces of test gear are well worth learning – the waveform generator, oscilloscope and spectrum analyser. Using your device's audio module, Android and iOS apps can turn your phone or tablet into a compact test lab.

WAVEFORM GENERATOR

Every sound we hear is a complex mathematical combination of sinewaves, pure tones of a single pitch or frequency. The Waveform Generator app on Android turns out 16-bit precision sinewaves from 1Hz to 22,050Hz, dialed up with the app's rotary control wheel and tap-selected display digits. It also produces various colours of noise (brown, pink and white) plus advanced waveforms including amplitude and frequency modulation (AM/FM) and frequency sweeps. On iOS, Signal Generator does similarly, producing sine and cosine sinewaves, along with sawtooth, square and triangle waveforms.

A 1kHz sinewave is a defacto standard test signal for most audio work – having a good-quality 'sig-gen' on your phone is pretty cool.

SPECTRUM ANALYSER

A spectrum analyser enables you to see that complex mathematical combination of sinewave tones as a column graph of frequencies. In industry, spectrum analysers often handle frequencies up to tens of GHz and cost thousands of dollars. The Spectrum Analyzer app on Android allows you to view the whole audio spectrum (20Hz to 20kHz) on a tablet or phone, combining it with an oscilloscope view. It only uses the microphone input to capture real-time audio, so don't expect absolute accuracy, but it'll give you invaluable experience and understanding on how spectrum analysers work.

DIGITAL OSCILLOSCOPE

While a spectrum analyser displays sound in terms of frequency, an oscilloscope displays signals over time. The Spectrum Analyzer app on Android does both, showing the audio input in both time and frequency domains.

But things can get a whole lot more serious. Keysight (**keysight.com**, a double spin-off from Hewlett-Packard) makes digital storage oscilloscopes (DSOs) you can control from your iPad or Android device over Wi-Fi via your Windows PC.

For something more mobile, Oscium (**oscium.com**) creates DSO modules for iOS – for US$300, the iMSO-104 turns an iOS 5.0 or newer device with a 30-pin connector into a 5MHz DSO with one analogue and four digital inputs. The US$400 iMSO-204 adds a second analogue input and is available for both 30-pin and Lightning connector devices.

Test equipment is fast making use of PC technology, so it's inevitable we'll see this gear take advantage of mobile tech. If you're learning physics or electronics at school or university, your phone is no longer just a phone.

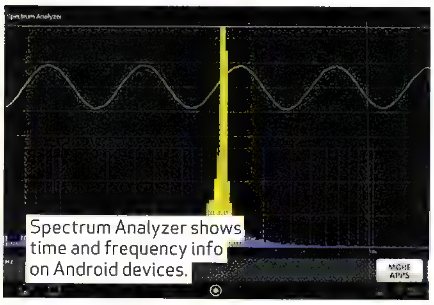
What you'll need:

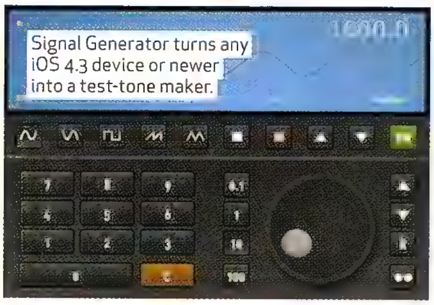
ANDROID

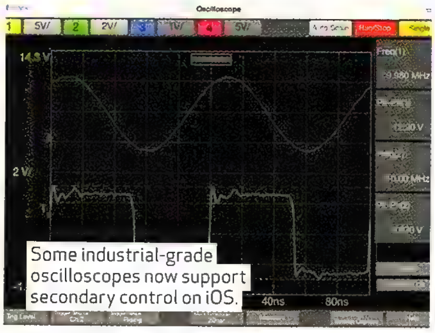
- Android tablet or smartphone with Android 3.1/Honeycomb or later and 800 x 480-pixel resolution minimum
- Waveform Generator app from Google Play
- Spectrum Analyzer app from Google Play
- Total cost: $2

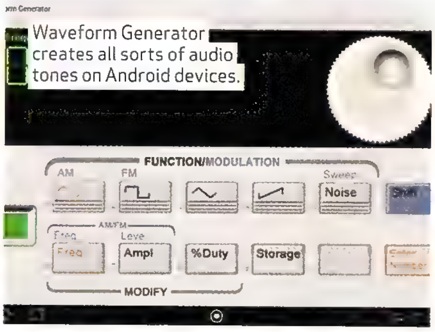
iOS

- iOS device with iOS 4.3 or newer
- Signal Generator from Apple App Store
- Total cost: $2
- Total time to complete: 10 minutes


Spectrum Analyzer shows time and frequency info on Android devices.


Signal Generator turns any iOS 4.3 device or newer into a test-tone maker.


Some industrial-grade oscilloscopes now support secondary control on iOS.


Waveform Generator creates all sorts of audio tones on Android devices.

Make your own Android apps and tech

Your Android device could help you change the world. **Darren Yates** reveals how to make your own apps and tech right on your Android device.

What you'll need:

- Android tablet or phone with Android 2.1 or up
- AIDE from Google Play (Android 4.0)
- QPython3 from Google Play (Android 2.1)
- BASIC! from Google Play (Android 2.1)
- Freetronics USBDroid dev board (Android 2.3.4)
- Total cost: Up to $100 (and in-app purchases)
- Total time to complete: varies

Some of the world's biggest tech companies sell mobile apps or build mobile peripheral devices. If you have an idea for an app or a device, don't just think about it – make it yourself using your old Android phone or tablet.

HOW IT WORKS – MAKING APPS

Normally, you code mobile apps on a full desktop or notebook development environment like Eclipse or Android Studio. But you can code Android apps – even bundle them into .apk packages – right on your Android device.

Android's native coding language is Java, which makes it the best choice with the full gamut of coding possibilities at your disposal. Get hold of AIDE (Android IDE) from Google Play and you can code, compile and package full-function Java apps on your phone or tablet. AIDE includes in-app-purchased Java coding lessons if you want them, but the coding environment (except for the debugger) is free.

CODING ALTERNATIVES

But if Java isn't your thing, there are other language alternatives you can still code on your Android device. Python is hugely popular in the Linux community and it's the defacto language for the Raspberry Pi. On Android, QPython3 gives you a port of the Python 3 language, offering clever tricks like tapping into Android's text-to-speech feature. You can't create standalone apps (Python is an interpreted language), but you can import Python code from elsewhere.

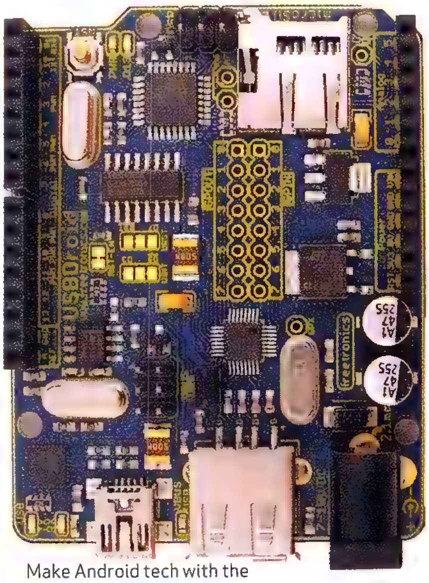
If Python doesn't do it for you, there's even a port of the BASIC language. Sure, BASIC gets smacked down for its GOTO statements, but BASIC! on Google Play not only gives you access to most of Android's more exotic features such as GPS, voice recognition and audio recording, you can even make standalone apps.

HOW IT WORKS – MAKING TECH

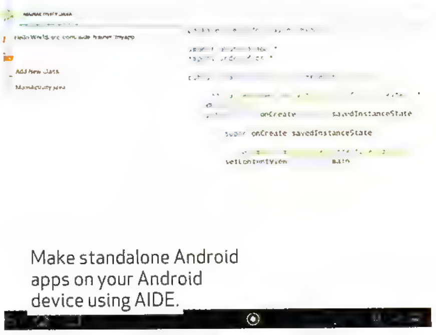
One of Android's lesser-known treasures is its support for making your own Android hardware gadgets. The Android Accessory Development Kit (ADK) is Google's end-user implementation of the Android Open Accessory (AOA) initiative to help hobbyists and businesses design and build peripheral devices such as Bluetooth weatherstations and fitness trackers that connect to virtually any Android device. Essentially, almost any idea you can come up with, you can probably make work via Android's ADK.

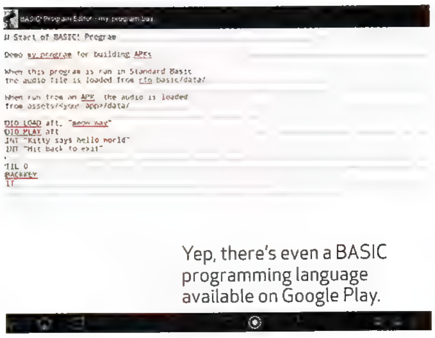
Originally, Google designed the specification around a 32-bit ARM Cortex M3 microcontroller, but since then, it's been adapted to work with the popular Arduino platform.

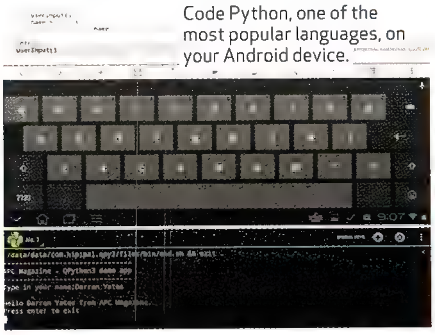
In Australia, local brand Freetronics has created the USBDroid (**tinyurl.com/p96dvfb**), an Arduino Uno board clone featuring a USB Host port and on-board microSD card reader. Jaycar Electronics sells it for $70. Online, you'll also find the Arduino Mega ADK, which adds the USB Host port to a standard Arduino Mega2560 board for around $40. But the cheapest option is a basic Arduino Uno board and a USB Host Shield, the combo you can pick up on eBay for around $20.


Make Android tech with the USBDroid Arduino board from Freetronics.

To get started, head to Arduino Labs and the ADK project page at **labs.arduino.cc/ADK/Index** – and make sure you read our Arduino Basics masterclass each month for how to make your own Arduino tech. ■


Make standalone Android apps on your Android device using AIDE.


Yep, there's even a BASIC programming language available on Google Play.


Code Python, one of the most popular languages, on your Android device.

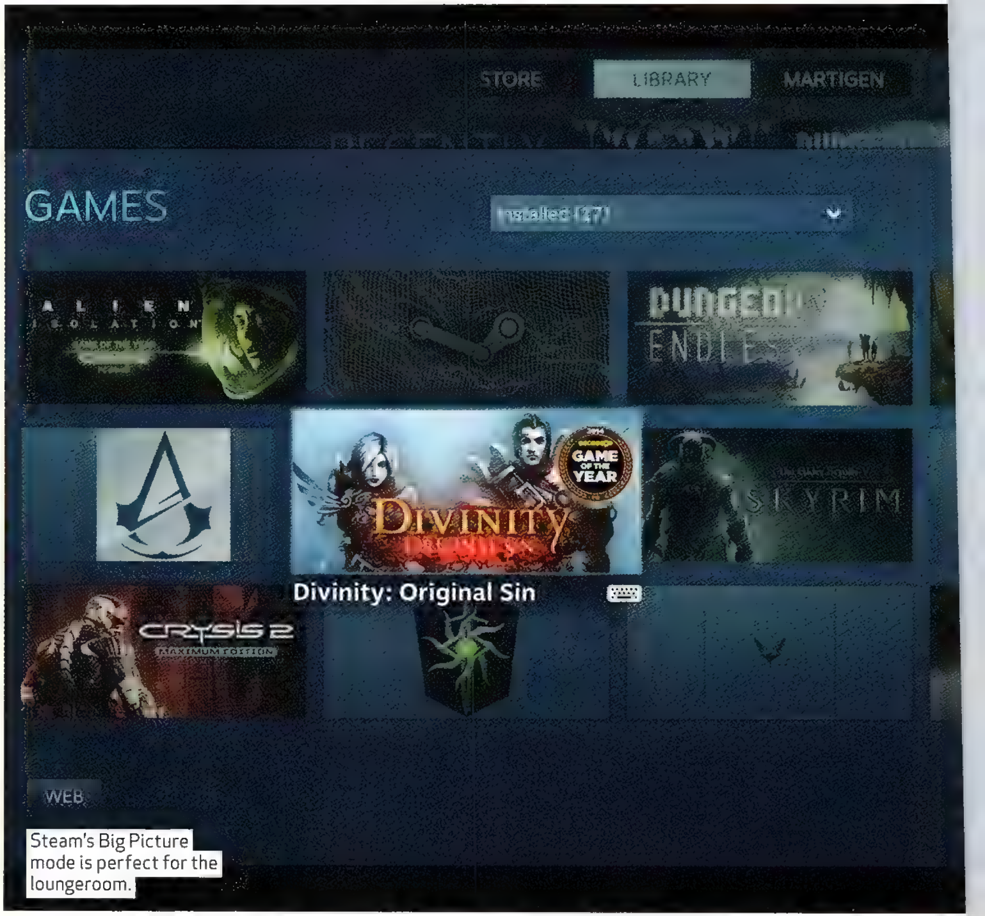
Make a Steam box

Ashton Mills sets up a dedicated lounge room gaming machine.

Steam is undeniably the king of gaming distribution for the PC, and last year Valve made known its move to take PC gaming from the man-cave to the living room with Steam Machines and SteamOS. Despite the moniker, a Steam Machine is just a PC, albeit perhaps more compact and made to look more living-room friendly.

Steam Machines run Steam OS, which is simply a customised Linux distribution. As Linux works really well on old hardware, using an older machine for a Steam Box (as we shall call our own version here) is an ideal task to get more mileage out of your past PCs.

Additionally, thanks to Steam's In-Home Streaming capabilities, a Steam Box can be used to not only play games on it directly, but stream games from a more powerful PC elsewhere in the house. This again makes older hardware ideal, if your old machine doesn't have strong GPU grunt you can instead use it as a streaming client.



Steam's Big Picture mode is perfect for the loungeroom.

What you need

CPU: Any dual-core and above should handle streaming without too much trouble. For playing games on the box itself, a beefier CPU will be needed. Valve makes note that the CPU must be 64-bit capable.

GPU: If you're streaming you don't need grunt, though Steam can take advantage of your GPU to decode its stream. Mostly though you'll need an HDMI out for your TV. If your GPU only has DVI, you can buy a DVI to HDMI adapter.

Memory: Valve recommends 4GB however Linux is nothing if not frugal and if you plan to only stream you can get away with 2GB (you must have a really old machine there!)

Disk: About 30GB for SteamOS + programs, then space for games you download. Streaming requires no disk space.

Input: This is a lounge-room entertainment box — you can use any old keyboard and mouse, but investing in a wireless set will mean no messy cables. Also note SteamOS supports XBox controllers through USB, so you can use a controller to play your games as well.

THE SOFTWARE

The easiest thing to do is follow Valve's instructions at **store.steampowered.com/steamos/buildyourown**, where you will also find download links for SteamOS. This next part is important: Valve provides two methods, and two different versions of SteamOS. The first is designed for OEMs and includes a compressed disk image that expects a 1TB drive. If your machine doesn't have one, or you don't want to give it so much space (and really... that's a *lot* of games to fill) use the 'Custom installation' method. The download link for this method lets you install on 500GB drives and less, and is a little more flexible.

Valve's next step in world domination

One more gotchya: both of these SteamOS images expect a UEFI-based machine. All new PCs are UEFI these days, but if your older hardware uses BIOS you'll need to use a third-party but officially endorsed version of SteamOS called Stephenson's Rocket at **github.com/steamos-community/stephensons-rocket**. This image is regularly updated with Valve's official releases and includes more options for installation (including RAID) as well as wider hardware support that includes catering to BIOS-based machines, making it ideal for older boxes.

Finally, don't forget – backup any data on the old machine you want first. Installing SteamOS will wipe the drive clean!

BATMAN BEYOND
BOB'S BURGERS
Bravest Warriors
Breaking Bad
Critic
Downton Abbey
Family Guy
Futurama
MacGyver
Metalocalypse
(26) Items - Page (1/3)

Kodi is one of the more well-known media server solutions.

Make a media server

Keep all your media in the one, easy to access place.

With so much media to consume from free to air TV, subscription TV, streaming TV, Blu-ray and DVD, iTunes, internet radio, and our own generated music, movies and photos you really need one place you can play it back seamlessly through your TV or other devices. That's where a media server comes in.

It's worth noting that if you want to use a solution using a server/client model, instead of all-in-one, you're going to need more than one PC (in addition to devices you might already have, like smartphones and tablets). Just something to keep in mind, but maybe you have more old hardware to find a use for?

THE SOFTWARE

There are plenty of options to choose from here, many more than we can cover. Here's some of the more well-known options:

- Kodi (**kodi.tv**) Formerly XBMC, Kodi is a media center framework that can be installed on everything from Windows and Linux down to a Raspberry Pi. It can also be had as a bundled Linux distribution called Kodibuntu, based off Ubuntu. Numerous plugins allow you to extend funtionality, and it's free.
- MythTV (**www.mythtv.org**) Also built on Linux though a version for MacOS X is available, MythTV has been a player in the space for a long time. It's fully featured and does everything from managing your media libraries to scheduling and recording TV. A strong contender to Kodi, and also free.
- Plex (**plex.tv**) Plex has made a name for itself by making it easy to manage your media and transcode it on the fly while it streams to other devices (be it a TV, or your smarthphone). Once forked from XBMC, it's now it's own product, clients exist for iOS, Android and range of Smart TV manufacturers. Note some features require a paid subscription.

Also be sure to check out Serviio (**serviio.org**), Media Portal (**www.team-mediaportal.com**), and Amahi (**www.amahi.org**). What about Windows Media Center? While it had a great interface and worked well, Microsoft has been slowly killing it off, and recently announced it wouldn't be available or supported for Windows 10.

What you need

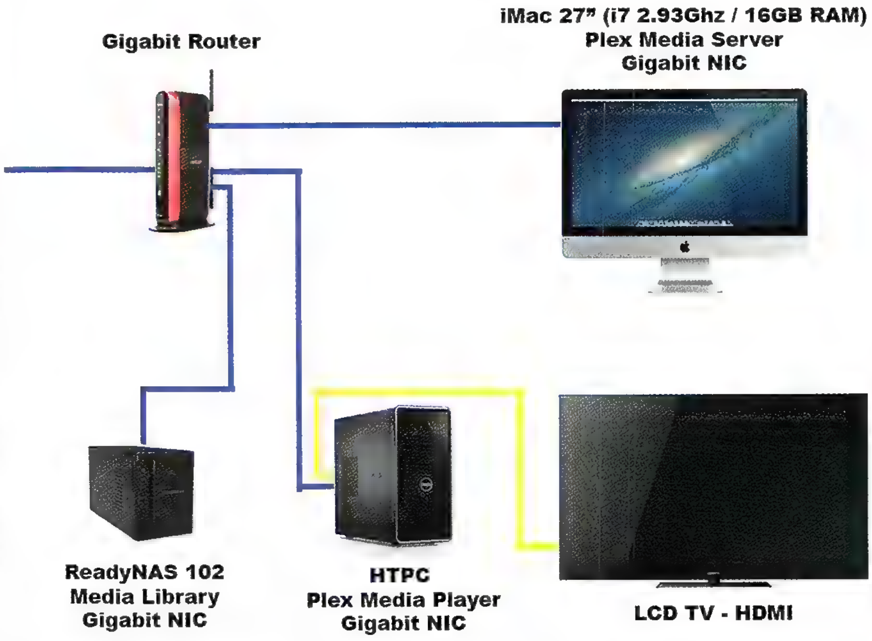
CPU: You don't need a powerhouse to playback music, movies and TV, a simple dual-core would suffice. If you plan to rip and encode Blu-rays, DVDs and CDs for your own digital library, a faster processor will do it quicker. Transcoding media on the fly to stream will also benefit from more CPU grunt, a quad-core would be good here if you want to serve multiple simultaneous streams.

GPU: 3D is used to render fancy media center graphics, so a GPU is usually required, but doesn't have to be powerful. HDMI a must if connected to a TV.

Memory: At least 2GB for a media player client PC connected to the TV, or 4GB for a server or combined server/player.

Disk: If this is going to be in the lounge-room, an SSD would be quieter and cooler. In terms of space, if acting as a server and storage, as much hard drive space as you can throw at it. If loading from a NAS, you just a need a single, small, hard drive for OS and programs.

Input: Wireless keyboard and mouse, XBox controller, or an infra-red controller. You can buy cheap USB-based infra-red remotes, but be sure they're supported by your media center software and operating system first. Alternatively, some solutions provide iOS and Android apps to control your media center too.



An example setup of a Plex Media Server, Plex Media Player, and a NAS.

Build a NAS

A NAS box is great for set and forget backups.

You can buy an all-in-one NAS, but it's cheaper to make your own.

In this ever connected digital world we're generating and consuming more and more content every day. Whether you're wanting to store your music and photos, backup games or re-encode your Blu-rays and DVDs for posterity, it all has to be stored somewhere. A home NAS (networked-attached storage) box is the perfect solution, allowing you to share all your content over a network whilst also preserving it if you build it with data-redundancy. And a NAS needs very little computing resources to do this – so old hardware is the perfect candidate.

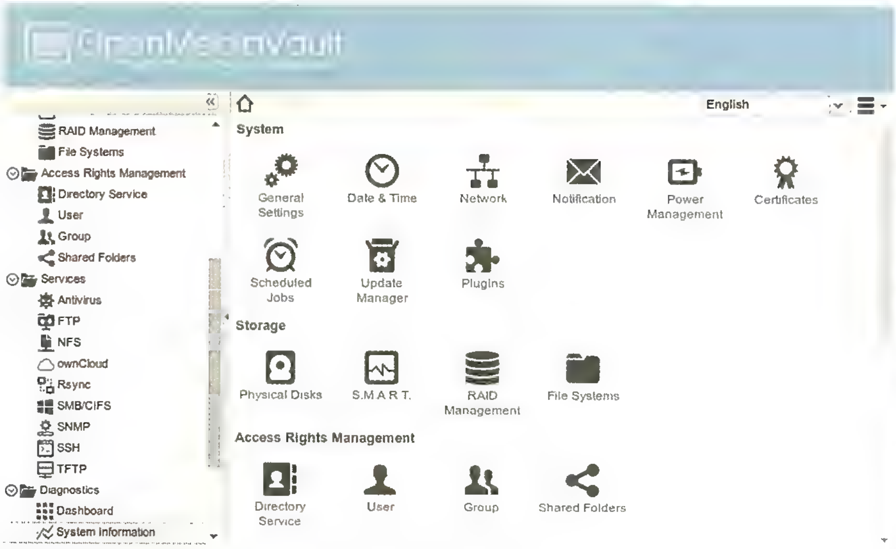
The main thing to think about, beyond if you want to purchase extra drives, is how power-hungry and loud your old PC is. NAS boxes don't need a lot of power, and since they tend to be always-on, removing unnecessary cards and even down-clocking the CPU can help you conserve energy. Less power also generates less heat, and if your case has fans this will also mean the NAS will be quieter.

If you can go with extra drives this will allow you to RAID them, ideally in RAID 1 for data redundancy. For this they need to be same size, and ideally same make and model though it's not strictly necessary. You will however want to have all the drives installed in the machine before you install the NAS software, as configuring them will be part of the setup process.

THE SOFTWARE

There are a number of options for your NAS software – the most popular are the BSD-based FreeNAS (**www.freenas.org**) and NAS4Free (**www.nas4free.org**) or if you prefer Linux there's Open Media Vault (**www.openmediavault.org**). Instructions for installing these are easy, but it's best to follow the documentation for each if you haven't used them before.

Windows options include, well, just your old Windows install as is – simply set up network shares and, if you want to use RAID, Windows provides its own software-raid through its Disk Management console. There's less flexibility as there's no central browser-based interface for managing it, but it works in a pinch. There's also, of course, Microsoft's Windows Home Server which can do more than just serve files (such as managing backups of Windows machines) if you can find a copy, given Microsoft has now rolled it into the more expensive Windows Server Essentials.



OpenMediaVault
RAID Management
File Systems
Access Rights Management
Directory Service
User
Group
Shared Folders
Services
Antivirus
FTP
NFS
ownCloud
Rsync
SMB/CIFS
SNMP
SSH
TFTP
Diagnostics
Dashboard
System Information
English
System
General Settings
Date & Time
Network
Notification
Power Management
Certificates
Scheduled Jobs
Update Manager
Plugins
Storage
Physical Disks
S.M.A.R.T.
RAID Management
File Systems
Access Rights Management
Directory Service
User
Group
Shared Folders

Open Media Vault is one of many options for setting up your own NAS.

What you need

CPU: Even an old single-core would suffice, so whatever you have will be fine.

GPU: Not needed! If there's one in the box, use it to setup the NAS via a display, but later you can remove it entirely.

Memory: Again, you don't need much. 1GB would suffice, but if more is available the NAS can cache more data in memory.

Disk: If your box has only one drive and that's all you want to use, you can do that. However, adding a few drives will give you more space and more versatility.

Input: Once it's setup, you don't need a keyboard or mouse either. NAS software lets you configure remotely over the network through a browser.

Build a retro emulation box

Relive your childhood and play the old school games you loved.

There's a lot of nostalgia about the forerunners of gaming – that era when EGA was cool and sound was just bleeps and bloops. If you grew up during this time you'll have fond memories of the games you played back then. But they don't have to be lost to the annals of time – there is in fact a vibrant emulator community for just about every classic gaming console and computer out there – so you can run everything from a Commodore 64 to a Nintendo Gamecube right on your PC. And, because technology moves at such a rapid pace, even an old PC or laptop can run emulator software and their games without breaking a sweat.

Another advantage is that emulators often bring with them features that weren't available with the original machine, such as adding anti-aliasing and rendering a game in high-resolution. In many ways, old games have never looked so good.

THE SOFTWARE

The are different emulators for different classic hardware. The more popular options include:

- MAME (**www.mamedev.org**) The Multiple Arcade Machine Emulator is the perhaps the most well-known, and has been in development for 18 years. It emulates, as the name implies, multiple classic arcade machines and while the main version is for Windows, Linux and MacOS X ports are available.
- Dolphin (**dolphin-emu.org**) Dolphin has a similar heritage going back 12 years, and emulates Nintendo's GameCube and Wii machines. Versions are available for Windows, Linux and MacOS X.
- Project64 (**www.pj64-emu.com**) Project64 is the go-to Nintendo64 emulator, ready and waiting to let you re-live your memories of *Zelda*. Project64 is Windows only.
- RetroCopy (**www.retrocopy.com**) Retrocopy emulates arcade machines, Nintendo's NES and classic Sega consoles including the Sega Master System. Versions are available for Windows and Linux.

There are a lot of emulators for game consoles, see Wikipedia's list at **en.wikipedia.org/wiki/List_of_video_game_emulators** to see if there's one for your favourite machine.

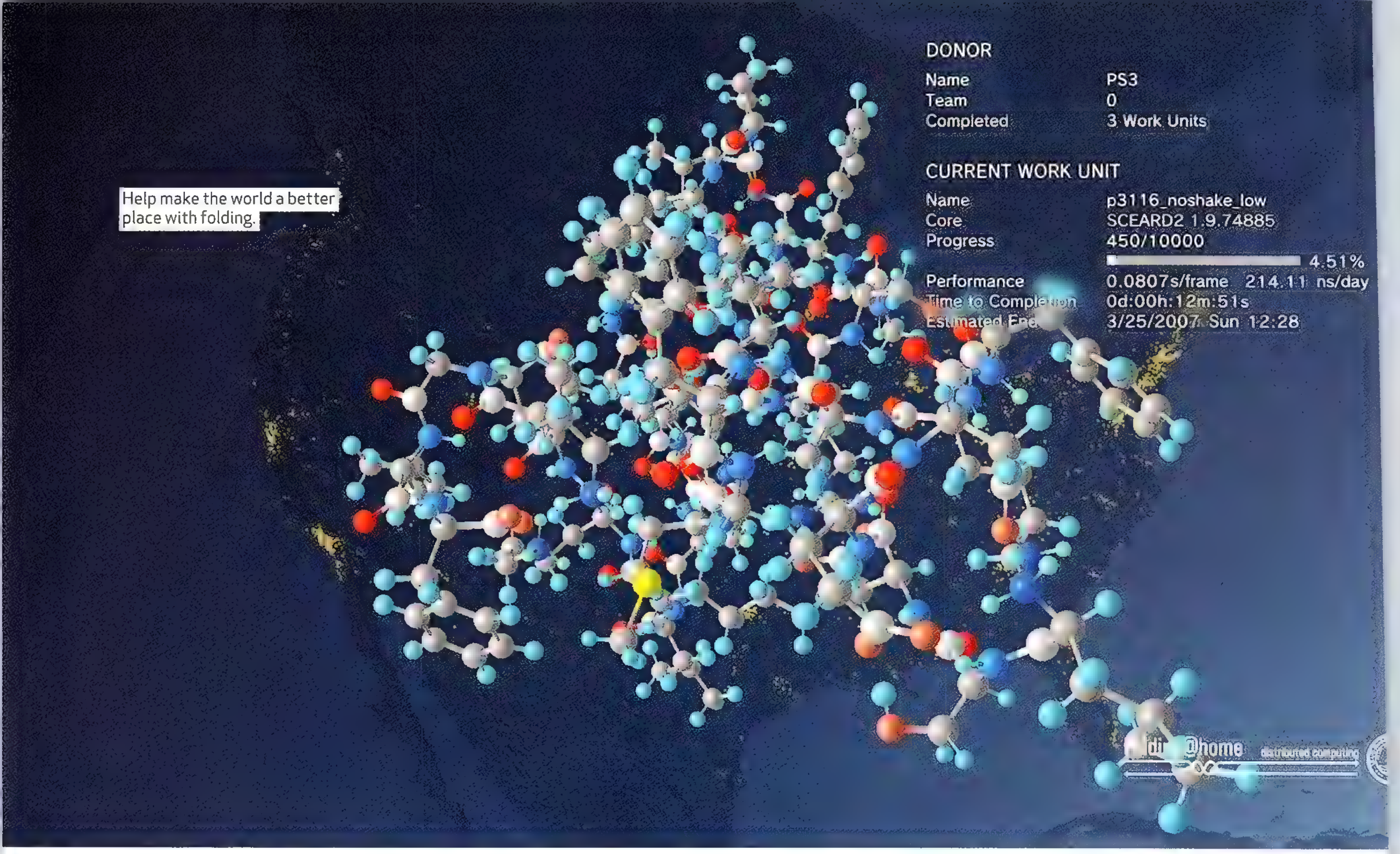
And, naturally, you also need the games (often called ROMs, in reference to how they were originally stored on cartridges) to play on the emulators. This is very much a grey copyright area, but hundreds of games can be easily found by searching online.

What you need

CPU: A dual-core and above will serve well, as emulators frequently render 3D graphics on the CPU to display. Some games will benefit from a fast CPU as the overhead of emulator and game can be demanding.
GPU: A GPU is still required, though it doesn't have to be a powerhouse. You don't need to run a high-resolution screen, either.
Memory: An old 2GB system will suffice for Windows or Linux plus emulator and games.
Disk: Emulators and the old games they allow to run are relatively tiny (think how much memory those old consoles had!)
Input: Mouse and keyboard, some emulators will also support joysticks (for that classic feel!) or an XBox controller.

Revisit old friends with the power of retro emulation.

mame
ULTIMATE
MORTAL KOMBAT
MIDWAY
You could go this far, but you don't have to.


Help make the world a better place with folding.

DONOR
Name PS3
Team 0
Completed 3 Work Units

CURRENT WORK UNIT
Name p3116_noshake_low
Core SCEARD2 1.9.74885
Progress 450/10000
4.51%
Performance 0.0807s/frame 214.11 ns/day
Time to Completion 0d:00h:12m:51s
Estimated En 3/25/2007 Sun 12:28

Contribute with compute

Is your PC pretty much outdated? Donate its remaining power to science.

If you remember, the term *computer* is derived from the verb *compute*, which despite outward appearances of the pretty GUI you use, is what your PC is doing under the hood. Though not very much of it, in the grand scheme of things – your PC spends most of its life idle, even when you're using applications.

So put that old hardware to work like it's never worked before, and contribute to *distributed computing*.

As the name implies, distributed computing harnesses thousands, sometimes hundreds of thousands, of computers around the world working to solve complex problems. You may have already heard of at least one of these – Folding@Home – that's been running for 15 years now working to further disease and drug research through protein folding at the molecular level. The type of thing we couldn't do without computers.

Once it's setup you don't need a monitor, keyboard or mouse. You can just let it sit in the corner and compute away, helping humanity. There are, however, some considerations to keep in mind:

Power: Whether CPU or GPU, processing takes power. This will eat your electricity more than, say, a NAS which spends most of its time doing nothing. If you're OK with that, great!

Heat & noise: A CPU or GPU under load generates heat, and so will need good cooling. This can also generate noise from fans, so factor this in also for its placement in the house.

THE SOFTWARE

There are many other projects you can lend your processor's time to. Here's our selection:

- **Folding@Home** (**folding.stanford.edu/home**) The simulation of proteins to help us understand diseases, drugs, and their interactions. This has already led to discoveries of new drugs, including those targeting Alzheimer's.
- **LHC@Home** (**lhcathome.web.cern.ch**) Be part of the world's largest particle collider and simulate particle collisions to help scientists understand the universe.
- **SETI@Home** (**setiathome.ssl.berkeley.edu**) Aliens are out there, if the *X Files* taught us anything. Help scan the skies for signs of alien life, bring *Star Trek* into the now!

For an excellent collection of projects to which you can donate processing time, see Wikipedia's list at **en.wikipedia.org/wiki/List_of_distributed_computing_projects**.

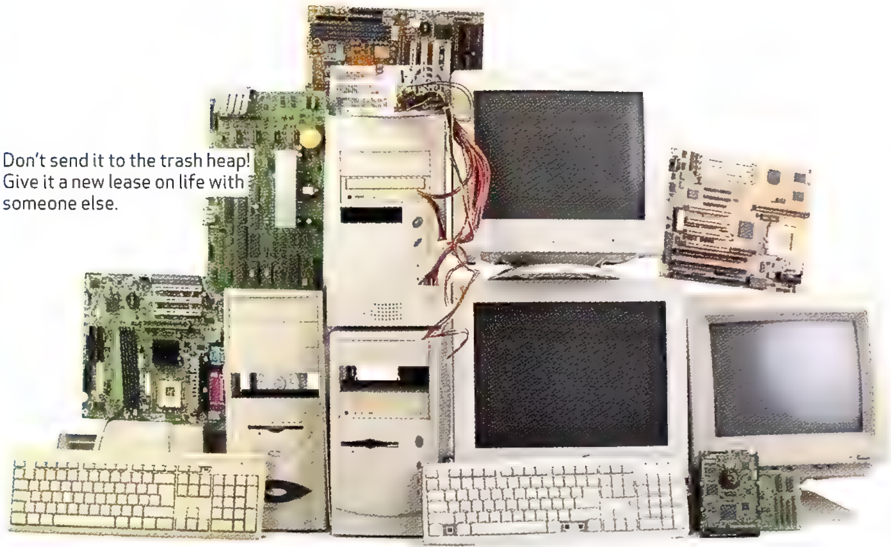
What you need

CPU: Whatever you've got, one core or 16 cores, some clients will use what you throw at it.

GPU: If you opt to just use your CPU, you don't necessarily need a GPU in the box. However, as some problems by nature can be solved in parallel, there are also distributed computing clients that can tap into the highly parallel nature of your GPU(s) too.

Memory: You don't need a lot, 2-4GB is fine, but if you process larger workloads or run multiple compute clients, more memory may be needed.

Disk: All you need is enough space for the operating system of choice (Windows or Linux, for e.g.) and the distributed computing client application. Even a small 64GB SSD will do, and since this machine will be on all the time, the power savings and quietness of an SSD can be really helpful.


Don't send it to the trash heap! Give it a new lease on life with someone else.

Give it away

Finished with your tech? Regift it!

Sometimes the best way you can make use of older hardware is to let others use it instead. Giving away your old computers to those who might have even older computers or none at all is a great way for your older gear to continue to serve, and make a difference doing so.

You might consider ways of doing this – from friends and family to simply giving it away cheaply on a site like Gumtree. However also consider there are charities that specialise in re-purposing old hardware. Check out **www.givenow.com.au/otherways/electricals** for a breakdown of some of these by state.

Whatever you decide, you're going to need to take a few steps first before your hardware will be ready:

BACK IT UP!

Remember to backup any data you want to keep! Once that hardware is out of your hands, it's too late to remove personal data.

CLEAN THE DRIVE(S)

It's simply common sense not to leave any personal data on the machine, and certainly not important documents. Cleaning a drive is easy to do, and there are plenty of tools that will do it for you. These include: CCleaner (**www.piriform.com/ccleaner**), check under Tools to find its Drive Wiper; the popular Darik's Boot and Nuke (**www.dban.org**); and the compact and lightweight File Shredder (**www.fileshredder.org**). Note you'll need to put the main drive in another machine to wipe it (you can't wipe the partition of Windows you booted from) or use a bootable wiper like Darik's.

Also note that HDDs are treated differently from SDDs. HDDs you should do at least one pass across the entire drive, and this could take a very long time (hours to a day, depending on the size of the drive). By their nature, SDDs are harder to recover data from but you can still clean the drive – instantly, in fact – by doing a secure erase. Some manufacturer tools like those from Samsung or Intel will feature a secure erase option in their software toolbox, otherwise there are plenty of third-party tools such as Parted Magic (**partedmagic.com/secure-erase**) that can do it too.

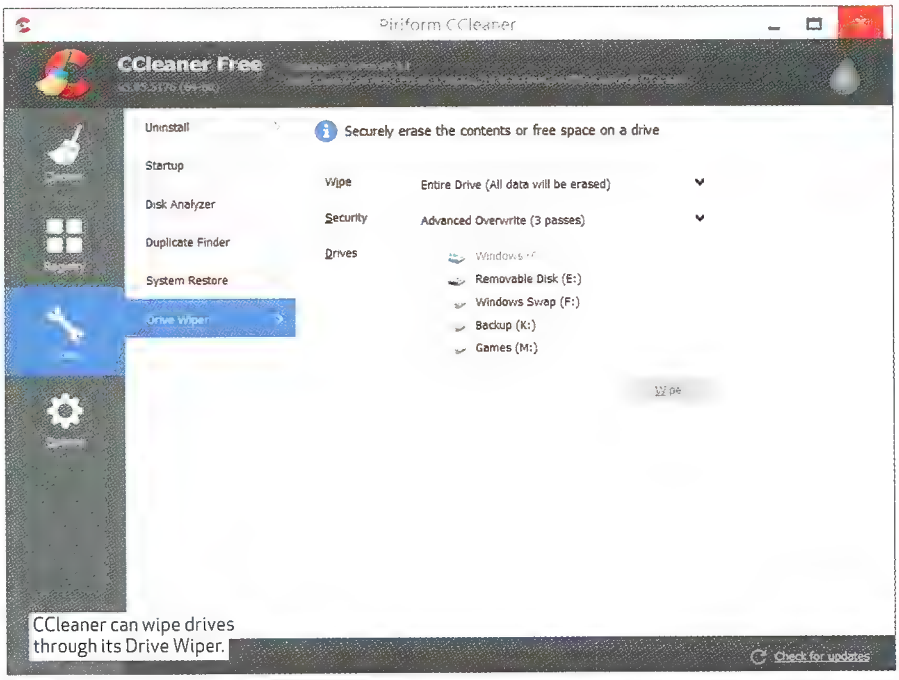
RE-INSTALL WINDOWS

If you're going to keep your license of Windows for your new machine, just leave this one blank. If however your new computer came with Windows, giving you another license, re-install Windows on the older box after wiping and give it away ready to go with license intact (that is, not used anywhere else). Charities and other organisations may replace this but not always, and it's one less step for them to do.

SPRING-CLEAN IT

Take the time to clean out dusty old fans, give the box and monitor a wipe and the keyboard and mouse a good clean, and generally make the machine presentable. Also note if you've tinkered and tailored the box, especially if it's overclocked, get back in the UEFI or BIOS and restore it to default settings. You want to make sure the machine will be as reliable as possible in its new home (which may well be someone not as computer literate as you).

Don't forget to pack it up with a power cable as well as any other accessories you're giving away. ■



Securely erase the contents or free space on a drive

Wipe: Entire Drive (All data will be erased)

Security: Advanced Overwrite (3 passes)

Drives:
- Windows
- Removable Disk (E:)
- Windows Swap (F:)
- Backup (K:)
- Games (M:)

CCleaner can wipe drives through its Drive Wiper.

Resurrect a router

Nathan Taylor discloses how you can create a secure-access internet router.

Some routers are easy to upgrade to DD-WRT. Some are not.

Got an old broadband router on hand? You may be able to use it to make your browsing super private.

If you've an old wireless router lying around, one of the most useful things you can do with it is install a third party firmware that supports VPN. Then, you can set it up so that any device that connects to it is automatically connected to a VPN service. This way, if you just want regular internet service, you connect to your main router; if you want secure VPN internet service, you connect to the flashed secondary router.

1 INSTALL DD-WRT

This is probably the trickiest part of the equation. DD-WRT remains our favourite third-party firmware, but you do need to be careful installing it. Head to **dd-wrt.com** and look up your router model in the router database. There are specific guides and firmwares for each router model, and you must pay close attention to your model's instructions. Then connect your computer directly to the secondary router with an Ethernet cable and follow the instructions.

If you're lucky, the process is as simple as hard resetting the router and using the web interface to upgrade the firmware. Some routers, however, require more elaborate rituals to convert to DD-WRT.

2 SET IT UP AS A CLIENT FOR YOUR EXISTING NETWORK

Now we want to set the router up to use your main internet connection – that is, to connect it to your primary router. Connect the WAN port on the soon-to-be VPN router to a LAN port on the primary router with an Ethernet cable.

You want to give your router internet access. Log onto the DD-WRT admin page at 192.168.1.1 and change the following settings:

- Set the WAN Connection type to Automatic Configuration DHCP.
- In the Router IP, set the local IP address to something that doesn't clash with your main router. The third number should be different from the third in the main router IP address. (For example, if the main router IP is 192.168.1.1, use 192.168.2.1). Subnet mask should be 255.255.255.0.
- This new IP address will be the one you now have to use to access the admin page.

3 CONFIGURE WIRELESS

Head to DD-WRT's Wireless settings and set up a wireless network on the VPN router. Of course, the usual wireless security rules apply: use WPA2 and give it a good password.

4 CONFIGURE THE VPN

Now to set up the router as a client on the VPN network. You can find the VPN configuration settings in 'Services › VPN'.

Most VPN service providers will have a guide to setting up their service on DD-WRT, and you'll need to check their help guides, since different providers use different settings.

PPTP is easiest to set up, since you only really need a server address, username and password. PPTP is less secure than OpenVPN, however.

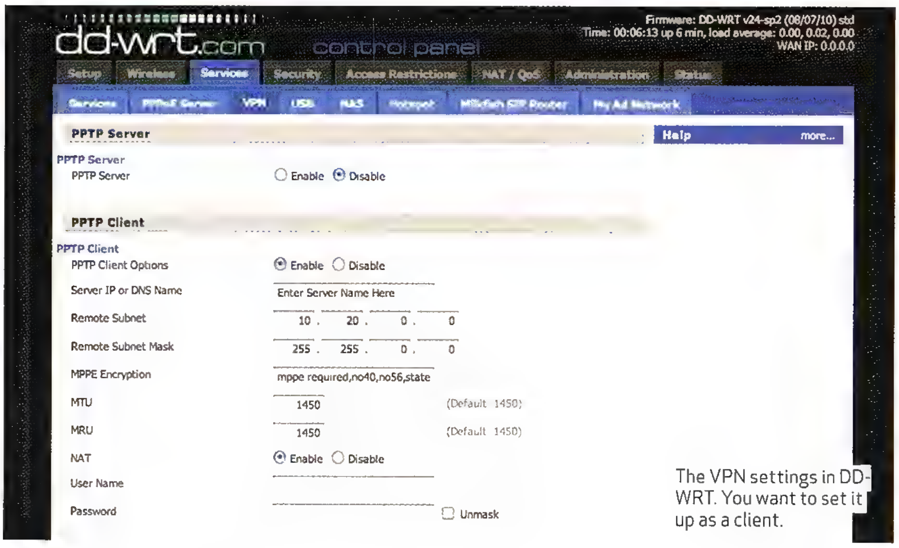
OpenVPN typically requires a more involved setup, and you'll likely have to copy and paste scripts and authentication certificates into the appropriate fields.

ALL DONE

Once the router is connected to the VPN, you should see that its WAN IP (at the top of the page) becomes the VPN IP address. Any device connected to it – wirelessly or through a wired port – will now route all internet data through the VPN.

Separate networks

In this configuration, devices connected to the secondary router cannot talk to devices connected to the primary router. If you have devices in your home that you want to talk to each other (if you have a home server, for example), it's best to connect them to the same router. Otherwise you'll have to mess with advanced IP forwarding settings, which can be tricky.



Firmware: DD-WRT v24-sp2 (08/07/10) std
Time: 00:06:13 up 6 min, load average: 0.00, 0.02, 0.00
WAN IP: 0.0.0.0

PPTP Server

PPTP Server
PPTP Server ○ Enable ● Disable

PPTP Client

PPTP Client
PPTP Client Options ● Enable ○ Disable
Server IP or DNS Name: Enter Server Name Here
Remote Subnet: 10 . 20 . 0 . 0
Remote Subnet Mask: 255 . 255 . 0 . 0
MPPE Encryption: mppe required,no40,no56,state
MTU: 1450 (Default: 1450)
MRU: 1450 (Default: 1450)
NAT ● Enable ○ Disable
User Name
Password ☐ Unmask

The VPN settings in DD-WRT. You want to set it up as a client.

Re-use your old monitor

Follow **Nathan Taylor**'s advice to create a digital picture and media frame.

By adding a cheap Raspberry Pi to an old PC display, you can repurpose it as a media or photo frame.

So you've upgraded your monitor to a new 30-inch monster, and you're wondering what to do with your now dinky-seeming 19-inch squeeker? Well, if it's a CRT, we'd recommend recycling or turning it into a fish tank. If it's a flat-screen, however, that's something we can work with.

One thing you could do is connect it to an old gaming console to make it a retro-gaming station – although you may need some kind of scan converter/display adapter if the console output doesn't match the monitor input.

But another cool thing you can do is turn your old monitor into a digital picture frame and media player. You'll probably need a few extra parts – after all the monitor doesn't have the computing smarts built in to store and display media – but it shouldn't cost you much or take up much room.

INDUSTRIAL REDESIGN

Don't be afraid to mess around with your old monitor. Strip out the stand and any bulky backplates if you want, especially if you've a view to hanging it on the wall. As long as all the electrical connections are unchanged, it should work just fine (although dust might be a problem if its innards are exposed).

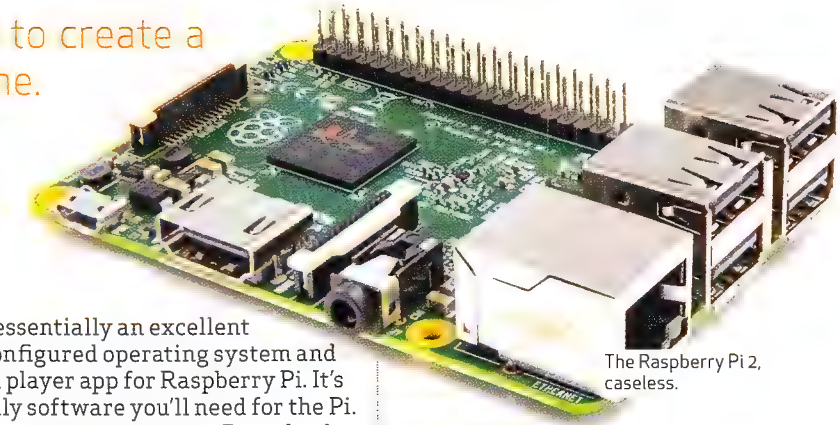
THE EXTRA HARDWARE

Now we need to talk about the controller. Perhaps the cheapest option you have is a Raspberry Pi 2, with Micro SD Card (16GB or even 8GB is enough, if you want to stream pics from your PC) and Wi-Fi adapter. You might also want a nice looking case for your Raspberry Pi – although if you're designing something funky for your old monitor, you can integrate the Pi into that as well.

At places like **www.raspberryworx.com.au** or **www.buyraspberrypi.com.au** that will collectively set you back about $80. Make sure you get the Raspberry Pi 2.

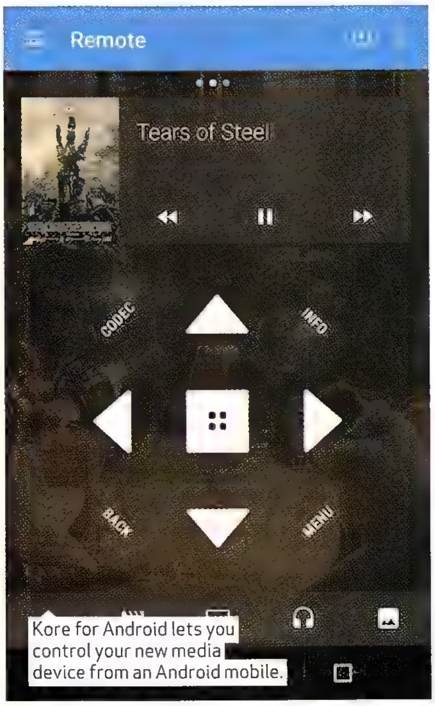
THE SOFTWARE

OSMC (**osmc.tv**) is our favourite tool here. OSMC is the project formerly known as Raspbmc, a build of Linux-with-XBMC (which is itself now known as Kodi) that runs on Raspberry Pi hardware.


The Raspberry Pi 2, caseless.

It's essentially an excellent pre-configured operating system and media player app for Raspberry Pi. It's the only software you'll need for the Pi.

It's pretty easy to set up. Download the installer from the OSMC web site. Grab the Micro SD Card from the Pi and plug it into your PC. Run the installer, which will build the operating system on the SD Card for you. Then plug the card back into the Raspberry Pi.



Kore for Android lets you control your new media device from an Android mobile.

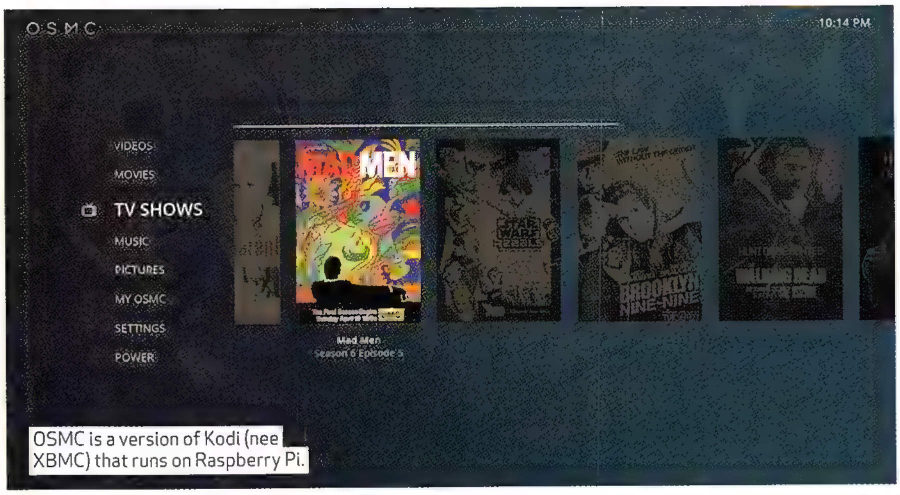
CONNECTING THE PI TO THE OLD MONITOR

Then all you have to do is connect your fancy new media player device to the old monitor. The Pi only has HDMI output, so you may need a HDMI-to-DVI adapter if your monitor lacks HDMI. If it doesn't have speakers (and you care for audio), you may also need speakers – the Pi has a 3.5mm audio out jack.

Just for the initial setup, you may want to connect a USB mouse and keyboard to your Raspberry Pi. This allows you to quickly set up Wi-Fi connectivity and 'sources' in OSMC/Kodi. This points the device at local or network media shares.

Otherwise, it controls just like the desktop version of Kodi, with options for photo slideshows, queued and looping video playlists and music playlists.

Once you set it up, you can disconnect the keyboard and mouse and control it with your mobile. You'll need the Android app Kore (available from Google Play) which gives you complete control over your new stand alone media centre device. ■



OSMC is a version of Kodi (nee XBMC) that runs on Raspberry Pi.

Responsibly recycle your old tech

Joel Burgess says it's finally time to let your old tech go. Use it to earn cash, contribute to charity or make the technology of tomorrow.

A decent portion of the materials used in smartphones, laptops and PCs are comprised of either rare metals or chemicals that will not break down and can have negative environmental effects. This issue of *APC* has a number of articles in on all the fun ways you can reinvigorate old tech and there are dozens more creative ideas out there on the web.

But if you've got devices you're not keen on re-using, then liberating yourself of all your old gadgets can be good for both your state of mind and, sometimes, your wallet. If this is the path you wish to take then there are a number of ways you can dispose of them responsibly.

There are three main options to get rid of old tech in a way that benefits you or someone who needs it directly; sell it, gift it or give it to a charity. For that really old or broken bit of tech that no one wants, you can still feel good about disposing it by taking it to an e-waste collection point.

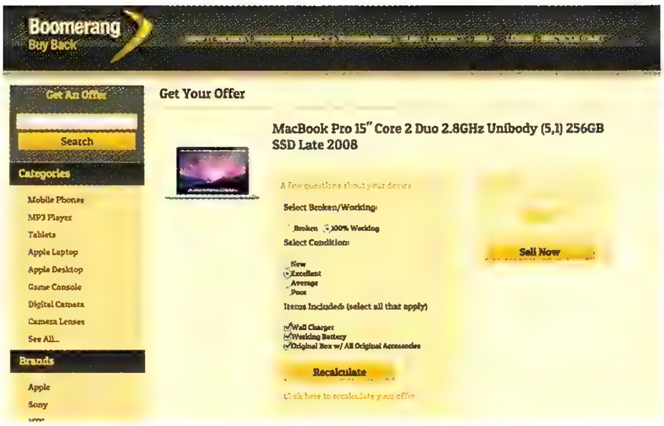
More than 90% of parts in contemporary phones can be recycled and it's estimated that there are over 23 million unwanted phones across Australia that are yet to be recycled, so chances are we all have at least one.

SELL IT

Boomerang Buy Back

(boomerangbuyback.com.au)

Boomerang Buy Back (BBB) is an Australian web site that will pay you for your old gadgets. The selection that it will buy is limited, but they do offer fair prices for MacBook Pros from as far back as 2008, so you may actually be able to get some decent cash for select older tech devices. The price offered is largely based on how recent the device is, alongside factors like whether it's in working order, the level of preservation and the inclusion of stock accessories. The company does buy a range of gadgets, so even though its price for phones is not quite as impressive as fonebank, if you have a bunch of different items to sell, the convenience of sending it all to the one place may outweigh the price difference. Another handy feature is that BBB will directly deposit money into your bank or PayPal account. If you're feeling extra generous, there's even the option for them to donate the proceedings to a charity that provides medical supplies for children with heart defects. When sending goods in, you either print off a delivery label through the web site or, alternatively, ask BBB to send you a pre-paid post satchel. The site even guarantees to wipe your devices for no additional cost – although we'd still



Get Your Offer

MacBook Pro 15" Core 2 Duo 2.8GHz Unibody (5,1) 256GB SSD Late 2008

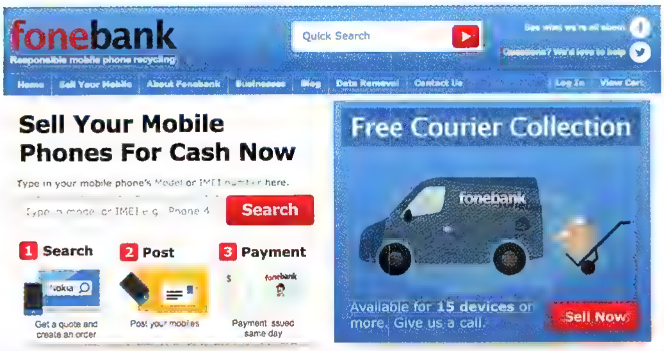
A few questions about your device

Select Broken/Working:
○ Broken ● 100% Working

Select Condition:
○ New
● Excellent
○ Average
○ Poor

Items Included: (select all that apply)
☑ Wall Charger
☑ Working Battery
☑ Original Box w/ All Original Accessories

Click here to recalculate your offer



Sell Your Mobile Phones For Cash Now

Type in your mobile phone's Model or IMEI number here.

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Post your mobiles

Payment issued same day

Free Courier Collection

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strongly advise you do this yourself. If you're looking to get rid of your tech, this isn't a bad place to start.

fonebank

fonebank.com.au

If you have an old smartphone that you're no longer using, fonebank offers the best consistent prices on used smartphones. fonebank will purchase devices that are not currently working, but it only offers two prices: a working price or a broken one. If your phone is only partially damaged – say the screen has a crack – fonebank classifies that as broken and, as such, BBB will likely offer you more. If your phone is in pristine condition, fonebank is the place to sell it.

The price offered for a working Apple iPhone 5 is $180 and older Samsung smartphones attract a similar price tag. HTC isn't too bad either, with some of the later One models fetching upwards of $100. If you're happy with the listed price for your smartphone, simply fill out an online form for either registered post – if you don't mind paying a few dollars for $100 of insurance cover – or reply paid post and take it to your local post office. fonebank's payment method is a little dated however: it'll write you a cheque when it receives the device and post it to you. If you happen to have a heap of phones or you're considering this for your whole household or office, then fonebank also offers free collection of more than 15 items.

eBay

ebay.com.au

If your second-hand devices are in particularly good knick, then it might be worth setting up an eBay auction for them. If you have the box, charger, accessories and a bit of time to take photos, write the item up and wipe the internal storage, you may be able to squeeze an extra few hundred dollars from your elderly tech using eBay. But there is always the risk that you will be offered less as well. Wiping an old Android or iOS phone is pretty straightforward and should only take you 10 minutes, although depending on how old your computer is, you may need to find special instructions online to reset it (and it's a process that can sometimes take hours).

> "More than 90% of parts in contemporary phones can be recycled and it's estimated that there are over 23 million unwanted phones across Australia that are yet to be recycled"

DONATING WORKING ITEMS

GiveNow

givenow.com.au/otherways/electricals

This Australian web site has a comprehensive list of charities and organisations that will take used computers, monitors, TVs and an assortment of other old tech. The services tend to be smaller local not-for-profits, and vary from state to state. Each organisation has slightly different stipulations on what types of technology it will accept and it'll therefore take a bit of research if you have lots of different devices. The vast majority are computer based, providing refurbished desktops or laptops for those in need or reselling them for a discounted price to students, disadvantaged communities and pensioners. Donating directly to charity will be slightly more difficult than say, selling through BBB, as some charities only accept large donations and most also require that you organise your own shipping.

The eBay for freeloaders

Alternatively, web sites like freecycle (**freecycle.org**) and Oz Recycle (**ozrecycle.com**) have community-based notice boards, where you can upload a description of your unwanted tech and other bargain hunters will arrange to come collect it from you. These are pretty basic web sites – freecycle doesn't have any image upload feature, for example – but there are active communities here, and the offer of a free smartphone or laptop is likely to get picked up quicker than a sack full of cow ornaments.

E-WASTE

Mobilemuster

mobilemuster.com.au

Mobilemuster is the official recycling representative of the Australian mobile phone industry and has been around since the late 90s. It's a not-for-profit jointly funded by Microsoft, Samsung, Motorola, HTC, Huawei, ZTE and a few telcos. They have established networks around Australia where you can drop off devices free-of-charge; generally, it's just a matter of delivering them to the nearest Australia Post office or local council center. Alternatively, you can download a printable label and mail them into Mobilemuster directly. The service will delete your phone's data for you, but it recommends that you still factory reset your devices yourself before disposal.

Planet Ark

recyclingnearyou.com.au

In addition to Techcollect (**techcollect.com.au**) – one of the bigger government backed e-waste collectors – there are a number of other similar services including dropzone, e-cycle solution, EPSA and reverse e-waste that all fall under the government's National Television and Computer Recycling Scheme. Planet Ark has helpfully pooled the locations for these tech drop off points into one map (**recyclingnearyou.com.au/ewastescheme/**) so you can find the nearest service to easily dispose of your e-waste. ■

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disc contents

» OUR SELECTION OF EXCLUSIVE FULL-VERSION PROGRAMS

ISSUE 416 JUNE 2015

NO DISC FOR NEW ZEALAND READERS?
Due to a New Zealand legal requirement that all physically-distributed video games (including indie titles and demos) must be rated by the Classification board, we're sadly no longer able to offer our cover disc in New Zealand. However, so our loyal NZ readers don't miss out, we've created a special download page where you can access the exclusive software each month. You'll find it at **www.apcmag.com/exclusives**. While we've created this download page for New Zealand readers, it's also open to all of our Australian and tablet-edition readers too. All you need are the passwords printed below to be able to download and extract these exclusive full-version apps.

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PLUS! [illegible]

PLUS! RONIN DEMO, HELLION: FULL GAME & 8 GREAT INTERNET MESSAGING TOOLS

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- A DVD-ROM reader or burner.
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- An internet connection may be required for online registration of software before use.
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- Check the disc using a virus scanner complete with the latest antivirus data updates. The disc was checked before burning, but new viruses are being discovered all the time.
- Back up any important system and data files. It is not recommended that the software contained on these discs be installed on production machines.
- If you have any questions regarding the use of the *APC* disc, click the 'Help' button at the top of the screen.

USING THE DISC

- Insert the disc into a CD/DVD-ROM reader or burner and your web browser should automatically load the interface. If not, launch your web browser and load the default.html file from the root directory of the disc.

HELP

- If you have any problems with the *APC* disc, please visit **www.apcmag.com/disc.htm**.
- *APC* provides no technical support for this disc or any software provided on it.

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RASPBERRY PI

The best new projects

Since the release of the Raspberry Pi 2, **Les Pounder** has been tinkering away in his garden shed and emerged with nine great projects for all levels of user.

The all-new Raspberry Pi 2 has arrived and it's more powerful than we could have hoped for. To celebrate this, and sales sailing past the 5 million mark, we're diving into the best Raspberry Pi projects. If you're either a beginner or an old hand, or just someone itching to do more with your all-new Raspberry Pi 2, there are projects here that will push your Pi and your brain to the limits.

Most of the projects will work on the original Raspberry Pi Model B, but we've indicated compatibility between boards and what you'll need for each one.

We've got Pi projects that embrace software, hardware and coding. Projects include building a cutting-edge Ghost blog to taking your first steps into the world of robotics. If you have a Raspberry Pi 2 to test out then skip to page 72 to get a full desktop version of Ubuntu up and running – it's impressive to behold. The Raspberry Pi has truly become a worldwide phenomena, it's already the best-selling home computer ever made and it's only going to go from strength to strength as it has suitably forward-looking leadership from Eben Upton and the Raspberry Pi Foundation. So if you want to get onboard there's no better way than throwing yourself into these projects and picking up some vital Linux and Pi knowledge. And that's a key point: you're not locked into working with the Pi only, much of this is FOSS/Linux knowledge, so you'll be able to take it with you and work on desktop and server systems.

> "Throw yourself into these projects and pick up some vital Linux and Pi knowledge."

Build a blog

Get that rant off your chest – install a lightweight but elegant Ghost blog using Node.js, Nginx and a Raspberry Pi 2.

For this project you will need

- A Raspberry Pi 2 model B or a Raspberry Pi model B or B+
- Raspbian OS
- Wi-Fi or Ethernet connection
- SSH Server running on your Raspberry Pi

Blogs don't need heavyweight hardware and thanks to the new Raspberry Pi 2, we can create a slick, responsive blog using three great open source projects: Node.js, Nginx and the Ghost blogging platform.

We start with a fresh Raspbian install that has been configured to run an SSH server. The easiest way to do this is via the raspi-config Advanced menu. We'll use an SSH client to log in to the Raspberry Pi remotely, but first we'll need the Pi's IP address, which you get by running ifconfig from LXTerminal (access it via the icon on Raspbian's desktop).

If you're connected via Ethernet look for eth0 and if you're using Wi-Fi it's wlan0. You're looking for the inet addr and the number after this is the internal IP address of your Pi. Using an SSH client on your computer (this comes as standard with Linux distros) log in to your Raspberry Pi:

```
ssh pi@IP_ADDRESS_OF_PI
```

What's LAMP?

In the past setting up a blog was quite a resource-intensive process. For starters you'd need to install a LAMP stack, which stands for Linux (the OS component), Apache (the web server component), MySQL (the database framework for storing content) and PHP (the scripting language that enables web pages to pass info to MySQL and create HTML content on the fly). All of these are used today for full-blown sites, but there's a growing trend for new technologies to replace this bloated process.

The new(ish) kids on the block are Node.js and Nginx. Node.js is a JavaScript framework that runs on the server and not in the user's web browser. This is used to power Ghost; from its user interface to its database capabilities.

Nginx is used to handle serving the web pages to users in a scalable way. This is a high-performance lightweight HTTP server and reverse proxy that's gaining a significant hold, where Apache was once dominant.

Once connected, you'll need to download Node.js and change directory to extract and install it:

```
sudo wget http://nodejs.org/dist/v0.10.28/node-v0.10.28-linux-arm-pi.tar.gz
cd /usr/local
sudo tar xvzf ~/node-v0.10.5-linux-arm-pi.tar.gz --strip=1
```

Now download and install Ghost into a directory in our home directory:

```
sudo mkdir ghost
cd ghost
wget https://ghost.org/zip/ghost-0.5.8.zip
unzip https://ghost.org/zip/ghost-0.5.8.zip
```

Node.js uses npm a packaging tool, which we'll use to install Ghost as follows:

```
sudo npm install --production
```

This will take some time to complete. Now run:

```
sudo npm start
```

This command will start the Node.js service and run Ghost in development mode. At this time we're simply testing that everything has been done correctly. To stop the server press Control+C. Now lets install Nginx to act as a proxy:

```
sudo apt-get install nginx
```

We now need to configure Nginx to work with Ghost. In LXTerminal change the directory to where Nginx's config files reside and delete the default configuration file:

```
cd /etc/nginx/
sudo rm sites-enabled/default
```

Next, we need to change directory to sites-available and create a new file called Ghost using the nano editor.

```
cd sites-available
sudo nano ghost
```

This file needs to contain the configuration to connect Ghost to Nginx, so users can access the blog:

```
server {
    listen 0.0.0.0:80;
    server_name ghostblog.com;
    access_log /var/log/nginx/*your-domain-name*.log;
    #root /home/pi/ghost;

    location / {
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header HOST $http_host;
        proxy_set_header X-NginX-Proxy true;

        proxy_pass http://127.0.0.1:2368;
        proxy_redirect off;
    }
}
```

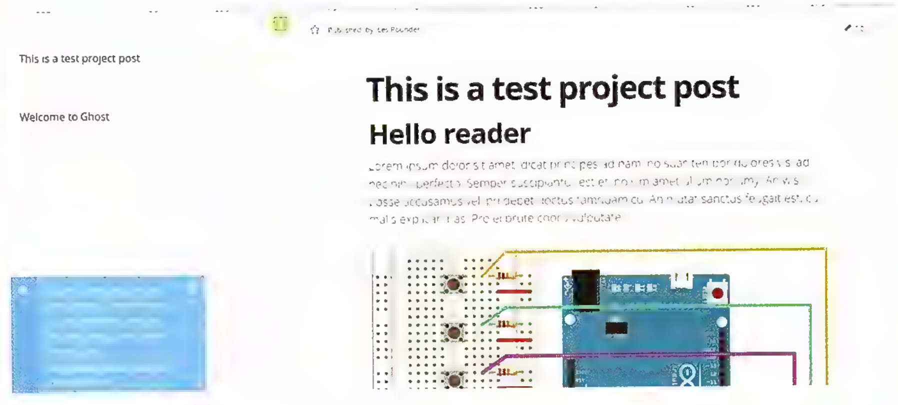
Save the file ('Ctrl-O') and exit nano ('Ctrl-X'), and change directory and create a symbolic link:

```
cd ..
ln -s sites-available/ghost sites-enabled/ghost
```

Nginx will listen for traffic on port 80 and will redirect it to Ghost. Last, we need to start the Nginx server and Ghost.

```
cd /home/pi/ghost
sudo service nginx restart
sudo npm start
```

On another device use a browser to navigate to the Pi's IP address, where you'll see the Ghost login screen. To learn more about Ghost head to **www.ghostforbeginners.com.**



This is a test project post

Welcome to Ghost

This is a test project post

Hello reader

Remote control your Pi

Use your Raspberry Pi from across the room or even from across the world using the magic of SSH and VNC.

For this project you will need

- A Raspberry Pi 2 model B or a Raspberry Pi model B or B+ Wi-Fi or Ethernet connection.
- Keyboard, mouse and monitor for set up
- Raspbian OS
- Power supply

Using your Raspberry Pi is normally accomplished via a keyboard, mouse and monitor but at times this might be awkward, like when controlling a robot or time-lapse photography rig. Remotely controlling a computer is nothing new but it's a handy solution to accessing your hard to reach Raspberry Pi project. In this project we'll install an SSH server, which will enable us to remotely control the Raspberry Pi using the terminal from another machine. We'll also install a VNC server which will enable us to use the Raspberry Pi desktop over a network.

Connect your Raspberry Pi and boot Raspbian to the desktop, you may need to log in using your username and password. If your Pi doesn't boot straight to the desktop type `startx` in LXTerminal and press Enter. If you're using a Wi-Fi dongle, make sure that it's configured and has an IP address. If you're using an Ethernet connection, open LXTerminal and type `ifconfig` to find your IP address.

Now we must configure the software that will run on the Pi and give us the access that we need. Open LXTerminal and type the following to setup an SSH server:

```
sudo raspi-config
```

Navigate to the Advanced Options Menu and look for SSH server, enable it and exit the application. If you're asked to reboot, do so and return to the desktop. With the SSH server installed we can now test that it works using another computer. We're using a laptop running Linux Mint and SSH'd into the Raspberry Pi using the terminal:

```
ssh pi@IP OF YOUR PI
```

The first time that you connect to the Raspberry Pi, SSH will ask you to confirm that the Pi is what you think it is via a unique fingerprint, and for this project we can accept that it's correct. After a few moments you will be asked for your Raspberry Pi password and need to successfully log into your Pi. Any command issued from this point onwards will be run on the Raspberry Pi.

With the SSH server successfully installed, our attention shifts to installing the VNC server. In the SSH session run the following command:

```
sudo apt-get install
tightvncserver
```

This installs the VNC server and to run the server type:

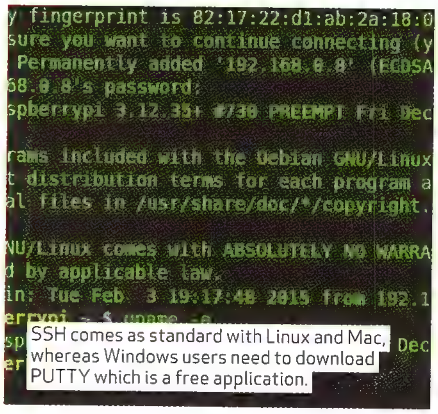
```
tightvncserver
```

You'll be asked for a password – use a strong one with a maximum of eight characters. You will also be asked for a view-only password that isn't needed at this time.

In the terminal you'll see the output of the tightvncserver command, and it will advise you that a VNC session has been started and that you can connect using the IP address or hostname followed by :1.

Now we need a VNC client on our computer to connect to the server running on the Pi. We've used Vinagre which comes installed on Linux Mint and Ubuntu. Open Vinagre and click on Connect, in the host box enter the IP address of your Raspberry Pi, followed by :1 and click Connect. You will be asked for your VNC password. With the correct password entered you can now use your computer's mouse and keyboard to control your Raspberry Pi and the Raspbian desktop is visible on your desktop.

For those of you looking to play *Minecraft* in this manner, we're sorry to say that, at this time, it's not possible due to the way *Minecraft* renders itself on the Raspberry Pi. Generally though, you're now able to use your Pi remotely from another computer in your home. In fact, you can have more than one VNC connection running, which will enable two people to share a Raspberry Pi.

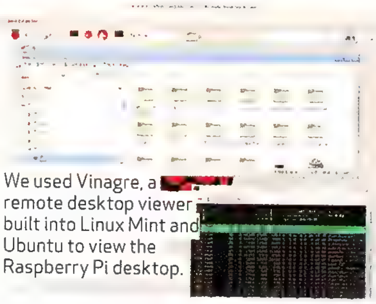


```
y fingerprint is 82:17:22:d1:ab:2a:18:0
sure you want to continue connecting (y
 Permanently added '192.168.0.8' (ECDSA
68.0.8's password:
spberrypi 3.12.35+ #730 PREEMPT Fri Dec

rams included with the Debian GNU/Linux
t distribution terms for each program a
al files in /usr/share/doc/*/copyright.

NU/Linux comes with ABSOLUTELY NO WARRA
d by applicable law.
in: Tue Feb  3 19:17:48 2015 from 192.1
errypi ~ $ uname -a
sp                                  Dec
er
```

SSH comes as standard with Linux and Mac, whereas Windows users need to download PUTTY which is a free application.



We used Vinagre, a remote desktop viewer built into Linux Mint and Ubuntu to view the Raspberry Pi desktop.

What's SSH and VNC?

SSH is used by system administrators to remotely work with servers across the world, for instance, a VPS or server running a web site or web application. Because there's no physical access to the device a user has to remote in using SSH either via a terminal, or using a web interface provided by a host.

SSH connections are encrypted and it's highly unlikely that anyone can see what's being done, unlike VNC which should not be used over the internet. VNC sends its information via an unencrypted connection and any VNC ports that are open can be scanned by malicious parties. In fact, there's a web site that lists web sites with open VNC ports and enables you to connect just like Chat Roulette. However, tunnelling a VNC connection via SSH, grants you a level of security.

There are SSH applications for all OSs and on Linux it comes by default, and VNC applications are installed with Ubuntu and Linux Mint in the form of Vinagre.

Build a smart TV

Build a media centre and make your TV smart using OpenELEC and a little bit of Pi tinkering.

For this project you will need

- A Raspberry Pi 2 model B (for best results) or a Raspberry Pi model B or B+
- OpenELEC
- Blank SD/Micro SD card
- Ethernet connection
- USB hard drive or flash drive
- Wireless mouse and keyboard

We have many ways to consume media these days but our main method is still through our TV (even if it might be via streaming technology). The Raspberry Pi is well suited to displaying media and since the day of its release users around the world have been creating media centres based on the Pi. In this project, we'll show you how to do it for yourself.

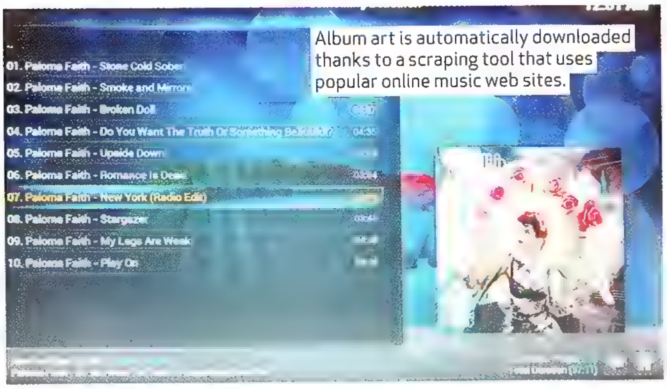
We start this project by copying the operating system to the SD card. For this we'll need to extract the contents of the file downloaded from the OpenELEC web site. This will extract an image file, which we need to copy to the SD card. To copy the image to our SD card follow the guidance at **tinyurl.com/npo8cl9**. Note: For whatever version of Raspberry Pi that you use, ensure that you have the correct image file as Pi 1 and 2 images are currently not compatible.

With the image copied to the SD card, insert it into your Raspberry Pi along with your wireless keyboard and mouse and other connections, such as Ethernet and HDMI to your TV. The last connection to make is the power which will boot your Raspberry Pi.

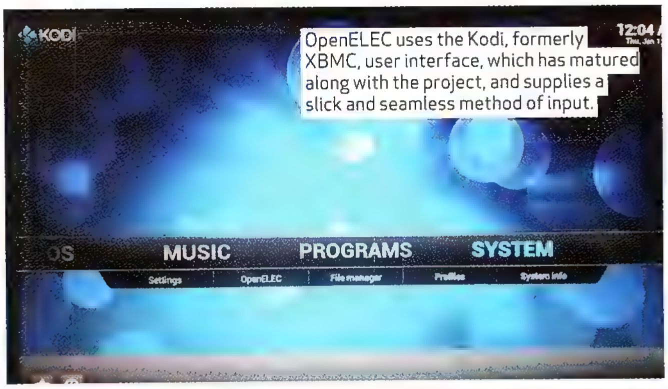
On your first boot up OpenELEC will lead you through a series of screens that will set up your media centre. Once complete you'll be returned to the main menu which is split into sections to catalogue your pictures, videos and music. With any of these categories you can easily import content from a variety of sources and the following steps are repeatable for all types of media that you wish to import. If you haven't already insert a USB hard drive, with movies copied on it, into your Raspberry Pi and then navigate to the Videos menu and then to Files. From here a new dialog box will appear and you'll be able to browse to the USB drive and the movies contained therein. Your movies will appear in the Videos library and you can select and play them from the list. Content can also be stored on network drives, such as a NAS, and OpenELEC can connect via many standards such as SSH, NFS and Samba, enabling content to be centralised in your home and available to multiple media devices.

OpenELEC also comes with a series of add-ons that can enhance the experience and you can find a selection of these in the Add-on menu for each category. A great video add-on is the Revision3 channel that broadcasts lots of maker and hacker-based shows. You can easily install the add-on by finding it in the list and clicking Install, and OpenELEC will handle everything from there on.

Controlling OpenELEC using a wireless keyboard and mouse is the default method, but there are other more stylish and consumer-friendly ways of doing things. First, there's FLIRC, (available from the PiHut store **tinyurl.com/n8pfw34**) which is an infrared receiver that can be programmed to use your existing remote to control OpenELEC. Alternatively, if you have a spare Android tablet knocking about there's a free app called Yatse (**tinyurl.com/c7obfmz**) that turns your tablet into a multimedia controller. This app can show your media catalogue on the tablet screen, and enable you to browse and select media which is then played on your television.


01. Paloma Faith - Stone Cold Sober
02. Paloma Faith - Smoke and Mirrors
03. Paloma Faith - Broken Doll
04. Paloma Faith - Do You Want The Truth Or Something Beautiful?
05. Paloma Faith - Upside Down
06. Paloma Faith - Romance Is Dead
07. Paloma Faith - New York (Radio Edit)
08. Paloma Faith - Stargazer
09. Paloma Faith - My Legs Are Weak
10. Paloma Faith - Play On

Album art is automatically downloaded thanks to a scraping tool that uses popular online music web sites.



OpenELEC uses the Kodi, formerly XBMC, user interface, which has matured along with the project, and supplies a slick and seamless method of input.

What's OpenELEC?

Media centres were one of the first projects to emerge for the Raspberry Pi on launch and they have gone on to become increasingly popular. In fact, they are so popular that the Raspberry Pi Foundation has invested in their development. Speaking to Eben Upton recently, he said that he's a keen user of OpenELEC and is extremely happy with the performance of the latest version on the Raspberry Pi 2 with it. While the Raspberry Pi 1 and 2 both share the same Videocore IV GPU which means that they both can easily work with large 1080p video files. The OpenELEC user interface is also quite a CPU-intensive process and it was common for users of the original Raspberry Pi to overclock their Pis to coax out every last ounce of performance. For Raspberry Pi 2 this isn't the case, because of the immense improvements made to the CPU and RAM, and means that Raspberry Pi 2 is clearly the stable base that you need to build your media centre upon.

Install Ubuntu 14.10

Installing Ubuntu on your Raspberry Pi 2 is now possible thanks to a great community project based on Snappy Ubuntu.

When the Raspberry Pi was first announced in late 2011 there were murmurs of Ubuntu support, but it didn't materialise because of the CPU powering the original Raspberry Pi. This situation continued for three years until the release of the Raspberry Pi 2 and its new Arm7 CPU, which has enabled Ubuntu to be installed on your Raspberry Pi 2. In this project we'll install it and configure it for daily use.

First download the Ubuntu image from **tinyurl.com/lx6zr5y** and then extract the contents using an archive manager. This will leave you with a 3GB image file. This needs to be written to your SD card using the dd command. With Ubuntu on your SD card, insert it and your mouse, keyboard, HDMI and power on your Raspberry Pi. Ubuntu will boot to a login screen within 30 seconds.

You will see the username linaro on the login screen, make sure that it's selected and enter `linaro` as the password and press Enter. After a few seconds the desktop will load. You will notice that it's not the default Unity interface, rather it's the LXDE desktop, as it's lighter on system resources.

For this project you will need

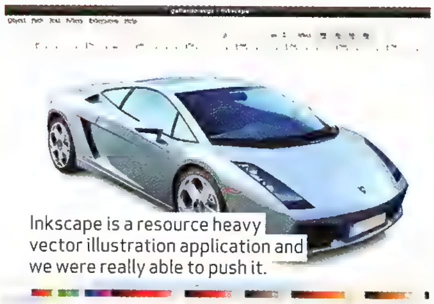
- A Raspberry Pi 2 model B
- 4GB SD card
- Peripherals to use with your Raspberry Pi 2, such as mouse and keyboard

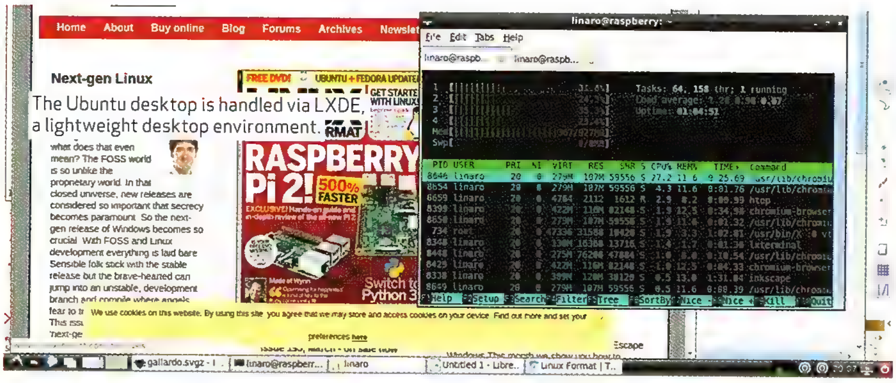
Next, we will install some applications, but first we will need an internet connection. If you have a Wi-Fi dongle make sure that it's inserted into your Pi and then go to the menu and navigate to Internet and select wpa_gui. If your Wi-Fi dongle is listed in the Adapter menu then you can connect using Wi-Fi, if not then plug in an Ethernet cable to continue. For those that are keen to hack Wi-Fi you can create a config file by typing:

```
sudo leafpad /etc/wpa_supplicant/wpa_supplicant.conf
```

Inside the file, type the following (inserting your SSID and password in the relevant sections):

```
network={
ssid="your network's ssid"
psk="your network's pword"
proto=RSN
key_mgmt=WPA-PSK
pairwise=CCMP
auth_alg=OPEN
}
```


Inkscape is a resource heavy vector illustration application and we were really able to push it.


The Ubuntu desktop is handled via LXDE, a lightweight desktop environment.

For those following the Wi-Fi instructions, once you've completed editing the file, save it and reboot the Raspberry Pi then log back in.

So now lets install some software. First, we shall make sure that our system is up to date. Open the terminal once again and enter the following commands:

```
sudo apt-get update
sudo apt-get upgrade
```

With our system up to date, let's install LibreOffice, the free office suite, by typing the following:

```
sudo apt-get install libreoffice
```

This will take a few minutes to download and install but once installed you can find it in the Office menu. Other applications to install are Gimp and Inkscape, these are image editing applications and can be found in the Graphics menu.

```
sudo apt-get install gimp
sudo apt-get install inkscape
```

Ubuntu won't replace Raspbian as the default distro for Raspberry Pi, but it's great to see another alternative distro. For the latest developments keep an eye on the official forum at **tinyurl.com/msq6q7r**.

Debian roots

Ubuntu and Raspbian both come from the same Debian upstream source. This means that you can install applications in the same manner for both distros. At the time of writing you can only install from the Ubuntu repositories for 14.10, Utopic Unicorn, but the community are hard at work bringing applications from the Raspbian repositories to the Ubuntu repos. During this tutorial we tested to see if we could add the Raspbian repos to our list of sources and while they imported without an issue, when we tried to install applications from the Raspbian repos it caused many issues with our system and so we stuck to the Ubuntu repository.

Currently, the Ubuntu project for Raspberry Pi is based on Snappy Ubuntu, an extremely lightweight version of Ubuntu that's intended to work with IoT (Internet of Things), and enable makers to use Ubuntu as a base in their projects. You can download the minimal Snappy Ubuntu from the Raspberry Pi web site.

Build an arcade cabinet

Partake in some gaming nostalgia — emulate old consoles and retro titles with your Raspberry Pi 2

For this project you will need

- Raspberry Pi 2 model B (for best results)
- Large capacity SD card
- USB joypad
- Peripherals to use with your Raspberry Pi 2, such as mouse and keyboard

In the 1980s and 90s there was an explosion of gaming consoles and home computers. Computer users of a certain age will have fond memories of machines such as the ZX80, BBC Micro and Megadrive/Genesis. These machines are now quite rare and this is where emulation plays a big part in helping re-live those glory days.

The Raspberry Pi is a popular choice for emulation as it's powerful enough to run emulators from Atari to upright arcade cabinets using MAME. The release of the Raspberry Pi 2 has also meant we now have an even more powerful processor that will enable emulators for later consoles, such as the PlayStation One, to run more smoothly.

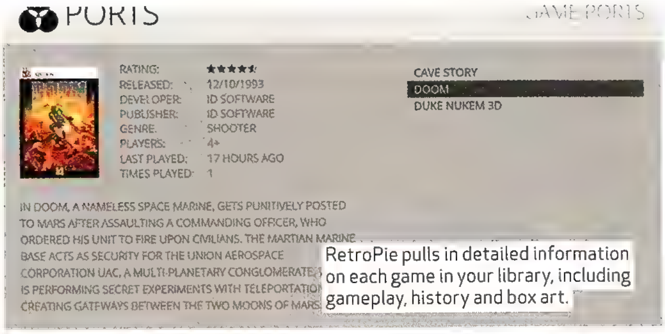
We shall be using the RetroPie emulator (**tinyurl.com/brfkbkf**). You'll need to copy the downloaded image to a blank high capacity SD card, the larger the better, and you'll need to use the dd terminal command to copy the image to an SD card.

With RetroPie on your SD card connect all of your peripherals, including any USB gamepads that you wish to use, to your Raspberry Pi and power up. On first boot RetroPie will ask if you would like to configure your joypad to work with the user interface. Note: There's a separate configuration for each of the emulators due to their differing joypad layouts. If you have a wired Xbox 360 controller there's a great guide on the RetroPie GitHub (**tinyurl.com/phrcnze**) for helping set it up.

RetroPie uses the popular Emulation Station as its user interface and by default there are a number of systems that can be emulated out of the box. These systems are identifiable by being active on the user interface. For each system there's a games library beneath it and this is created by inserting a USB drive into your Pi. A script creates the necessary file structure on the drive. Insert this drive into your PC and copy the ROMs from your computer into their corresponding folder on the USB drive. Now return the stick to your Raspberry Pi and RetroPie will automatically copy the contents to your install. By copying ROMs in this way their corresponding emulator is enabled in the Emulation Station user interface.

At this point, we need to advise you that ROMs are copyright material and remain the property of their owners. Their use in emulation is a grey area and many games are now so old that they are no longer commercially available, however, this doesn't mean that they are out of copyright.

With your ROMs installed go back to the user interface and select which system you would like to play. RetroPie will now ask if you would like to catalogue your games, before accepting, ensure that your Pi is connected via Ethernet to your router. RetroPie will search the internet for your games and download any box art and information about each title. Where there's a conflict it will ask you to choose which is correct, or if nothing is found it will ask you to manually enter the names of the games. RetroPie can emulate a number of systems, such as the Commodore Amiga, Sega Genesis and Super Nintendo, and on the Pi 2 there's no need to overclock the system as it runs six times faster than its predecessor. If you are using an original Raspberry Pi then you can streamline your setup using the Advanced Configuration steps on the RetroPie wiki (**tinyurl.com/ozvo7u4**).

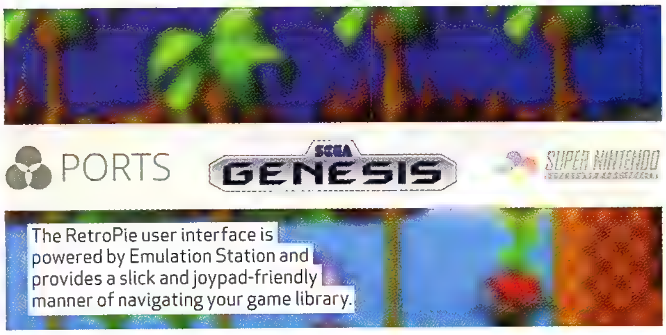


RATING: ★★★★½
RELEASED: 12/10/1993
DEVELOPER: ID SOFTWARE
PUBLISHER: ID SOFTWARE
GENRE: SHOOTER
PLAYERS: 4+
LAST PLAYED: 17 HOURS AGO
TIMES PLAYED: 1

CAVE STORY
DOOM
DUKE NUKEM 3D

IN DOOM, A NAMELESS SPACE MARINE, GETS PUNITIVELY POSTED TO MARS AFTER ASSAULTING A COMMANDING OFFICER, WHO ORDERED HIS UNIT TO FIRE UPON CIVILIANS. THE MARTIAN MARINE BASE ACTS AS SECURITY FOR THE UNION AEROSPACE CORPORATION UAC, A MULTI-PLANETARY CONGLOMERATE, IS PERFORMING SECRET EXPERIMENTS WITH TELEPORTATIO CREATING GATEWAYS BETWEEN THE TWO MOONS OF MARS.

RetroPie pulls in detailed information on each game in your library, including gameplay, history and box art.



The RetroPie user interface is powered by Emulation Station and provides a slick and joypad-friendly manner of navigating your game library.

The original Generation Code

There were many different games consoles and computers from the 1970s to early 2000s. Companies such as Commodore, Sinclair, Acorn, Dragon, Sega, Atari all competed for home computing dominance. This drove the rise of bedroom programmers; people who learnt to code from magazines of the time.

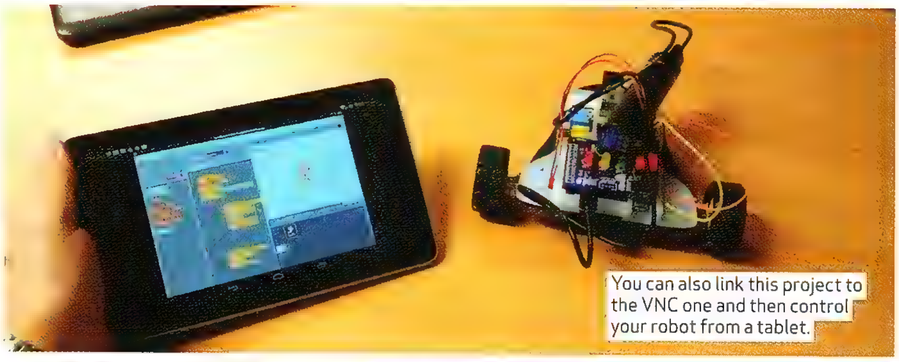
In each magazine there would be pages of BASIC code to type into your computer and learn coding via experience. This lead to a boom in the number of games being produced, and fuelled a generation of coders who are now hoping to reignite that spark with the Raspberry Pi. David Braben, for example, co-wrote the iconic *Elite* game in the 1980s. *Elite* was an entire galaxy full of planets, space stations and pirates in only 32Kb of memory. David Braben also happens to be one of the co-founders of the Raspberry Pi Foundation and is very keen to see children creating and learning with computers, rather than simply consuming content.

Take your first steps in robotics

Start your journey towards Skynet! Build a keyboard-controlled robot using ScratchGPIO 7 and a Pibrella board.

For this project you will need

- A Raspberry Pi 2 model B or a Raspberry Pi model A or B
- Pibrella (Cyntech)
- Two Micro Gear motors (Pimoroni)
- Wheels (Pimoroni)
- Ball caster for balance (Pimoroni)
- Arts and craft materials optional
- USB battery
- Wi-Fi dongle


You can also link this project to the VNC one and then control your robot from a tablet.

Building robots has become a 'rite of passage' for many Raspberry Pi owners, and thanks to initiatives, such as Scratch GPIO and Pibrella anyone can easily build a robot using easy to obtain components. This project will create a keyboard-controlled robot that we can control remotely using the VNC project on page (see page 70).

We shall start by connecting the Pibrella board to the Raspberry Pi; it fits over the first 26 pins of the GPIO and hovers slightly over the HDMI port. If there's contact between the Pibrella board and the HDMI port use a blob of modelling clay to prevent a short. Next, connect your peripherals to the Raspberry Pi, except for the power supply which will now connect directly to the Pibrella board. Turn on your Raspberry Pi and head to the desktop.

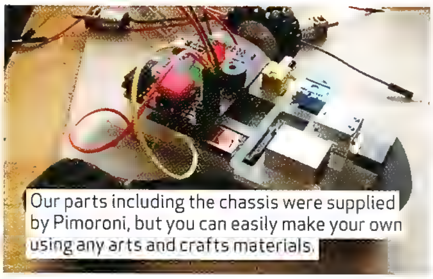
To use Pibrella we need to install some software first for which you'll need to be connected to the internet, in *LXTerminal* type the following line by line:

```
sudo apt-get update
sudo apt-get upgrade
sudo apt-get install python-pip
sudo pip install pibrella
```

Now we will install Scratch GPIO 7, which uses the familiar Scratch programming language interface to enable anyone to take their first steps with physical computing. In LXTerminal enter the following:

```
wget http://bit.ly/1wxrqdp -O isgh7.sh
sudo bash isgh7.sh
```

You should now see a Scratch GPIO 7 icon on the desktop. Launch the application and you will see the familiar Scratch interface. To use Pibrella with ScratchGPIO we must first create a variable called AddOn and then set the AddOn to Pibrella. Last, we create a Broadcast called AllOff. The Broadcast block is in the Control Palette and will be blank, requiring your input. To sit on top of these blocks use the Green Flag Start hat block, which means that the Pibrella board will reset everything to off once the flag is triggered. This will be an emergency stop for our robot. Now we need to create the code that will enable our robot to move when we press a key.


Our parts including the chassis were supplied by Pimoroni, but you can easily make your own using any arts and crafts materials.

First, lets create a way to move forward when the Up arrow is pressed. In the Control Palette there's a hat block called When Space Key Pressed. Drag that into your code and change the dropdown to Up Arrow. Under that block we will now create two new broadcast blocks: OutputEOn and OutputFOn, and these will turn on our motors once connected. From the Control Palette connect the Wait block and set it for two seconds. This will send two seconds of power to the motors. Last, create two new broadcast blocks OutputEOff and OutputFOff these will stop the motors.

Now connect your motors to outputs E and F and when ready run the code and press the Up arrow. Your robot will now move forward, if it spins then swap the wires around until it moves forward. To turn your robot you will need to turn only one output on, we connected the left wheel to E and right to F. So to turn right we would turn output E on and our left wheel would spin and the right wheel would be a pivot. Have a play with timings and control, and make this project your own.

Picking robot kits

Robotics is a great project to undertake, but there are lots of kits out there that claim to be the best, so which one is best for you? Well, the one that meets your needs.

The Pibrella-based robot in this tutorial is extremely simple in that it has no sensors and no reverse gear, but hopefully it should help spark interest in learning more. The Pibrella board is remarkably versatile and you can easily adapt this project into a motorised dice game or use it to power a quiz game, such as the *Wheel of Fortune* game (**tinyurl.com/pmcqe83**).

Pibrella also lowers the barrier for entry so that even young children can learn some simple electronics, using ScratchGPIO and then move on to Python — and all via a cheap board. Other boards to consider are the RyanTeck Budget Robotics Kit (see **tinyurl.com/kyrj9zg**) this is a motor control board and robotics platform that can also be programmed with ScratchGPIO and Python.

Build a better alarm

Build a laser tripwire with the Explorer HAT Pro add-on board and catch a burglar… or just your cat.

For this project you will need

- A Raspberry Pi model A+, B+ or Raspberry Pi 2 model B
- An ExplorerHAT Pro (Pimoroni)
- An LDR (Light Dependant Resistor)
- 10K resistor
- 3x Male to male jumper cables
- A torch or laser pointer
- A speaker or a monitor with audio capabilities
- Raspbian OS

The Explorer HAT Pro is the latest add-on board for the Raspberry Pi from Pimoroni and it packs in a lot of functionality. In this project we will build a laser tripwire that will raise the alarm when triggered. We'll start by first installing the two Python packages that will power our project. We'll use pip the Python packaging tool. To install pip3 enter the following into LXTerminal:

```
sudo apt-get install python3-pip
```

Next, install PyGame and Explorer HAT libraries:

```
sudo pip3 install pygame
sudo pip3 install ExplorerHAT
```

With the libraries installed we move on to creating the code that will drive our project. You can grab a copy from the LXFDVD or **tinyurl.com/of5s9hc**.

For this project, we used IDLE3 which we will need to run from LXTerminal using the command:

```
sudo idle3 &
```

We need to do this as only root or sudo users can use the Explorer HAT Pro. With IDLE3 open create a new file, or open the code from the GitHub repository.

The first three lines import three libraries that power our project. We're building the project on the Explorer HAT board, so we import that and rename it to eh to make it easier to work with. Next, we import the sleep function from the time library and last, we import the pygame library.

```
import explorerhat as eh
from time import sleep
import pygame
```

The next line starts the pygame audio mixer, which we will need to play our alarm:

```
pygame.mixer.init()
```

Now we move on to the main loop that we will use to form the basis of detecting an intrusion. We start by creating an infinite loop and create a variable which stores the status of the analog pin:

```
while True:
    a = (eh.analog.four.read())
```

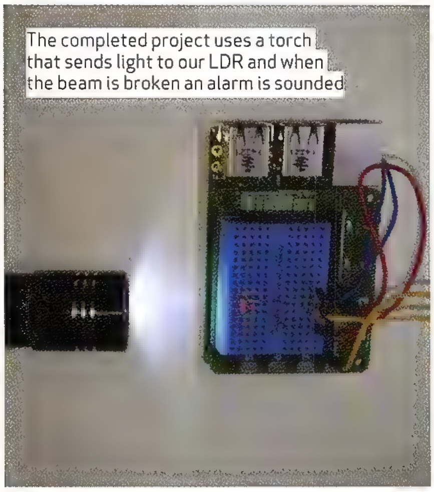
Next, we are going to use an if…else conditional statement to control how the alarm is triggered. We measured the light level in our room and found that it was around 2.6V on our analog pin. A torch shining on the sensor would be much higher than that, which meant we decided to set the LDR sensor so that anything above 3V is considered OK and would activate a green LED on the board:

```
if a > 3.0:
    print("SCANNING")
    eh.light.green.on()
    eh.light.red.off()
```

Our last section of code handles the alarm, which is triggered by the beam being blocked to the LDR. When this happens we turn the green LED off and turn on the red LED, and we trigger the playback of the alarm audio:

```
else:
    print("ALERT")
    eh.light.green.off()
    eh.light.red.on()
    pygame.mixer.music.load("./alert.mp3")
    pygame.mixer.music.play(1)
```

We now move on to creating the hardware element. The Explorer HAT Pro comes with analog input, which the Raspberry Pi hasn't got. Our circuit is rather simple: we introduce 5V of power in via the LDR, which is then connected to a 10K resistor. The LDR and resistor form a voltage divider and we connect that to the analog pin of the Explorer HAT Pro. Last, we attach the other end of the resistor to Ground (GND). Now we just need to point a Laser pointer or torch directly at the LDR and that completes the hardware and software elements. Make sure to double check your code and wiring before we continue. Start the project via the 'Run › Run Module' menu. The IDLE shell will spring to life and report that it's scanning. Now go ahead and break the beam, the alarm will sound and you have caught your first intruder!


The completed project uses a torch that sends light to our LDR and when the beam is broken an alarm is sounded

Nice HAT, Harry

The Explorer HAT Pro is the latest HAT-based board from Pimoroni, a company based in Sheffield that produces many Raspberry Pi boards. The Explorer HAT Pro introduces new technologies to an all-in-one board.

It comes with eight capacitive touchpads that enable users to use touch-sensitive buttons on the board and four of these buttons can be linked to conductive objects, such as fruit using crocodile clips and then used to create novel forms of input (see page 76).

The Explorer HAT Pro also comes with a series of analog inputs that aren't available on the Raspberry Pi, and this makes projects using temperature sensors possible. The most challenging aspect of the Explorer HAT Pro is the inclusion of a motor controller with full support for forward and reverse gears, thanks to dual H-Bridge. Add to this a breadboard and a series of digital inputs and outputs, and we have a great platform for future projects and ideas.

Turn a banana into a guitar

If music be the food of love, why not make music with food? Build a banana guitar using Adafruit's Capacitive Touch HAT.

For this project you will need

- A Raspberry Pi 2 model B or a Raspberry Pi model A+ or B+
- Adafruit Capacitive Touch 12x Sensor HAT
- Crocodile leads
- Bananas x7 (one to eat)

What if we told you that you could turn a banana into a guitar? Madness, but we're going to do just that with Adafruit's capacitive touch sensor HAT. But first we have to solder the 40-pin connector to the HAT's underside, so that it can slot onto the Pi GPIO.

Once soldered, attach the HAT, boot the Pi and open LXTerminal, where we'll start installing the required software:

```
sudo apt-get update
sudo apt-get install build-essential python-dev python-smbus python-pip git
cd ~
git clone https://github.com/adafruit/Adafruit_Python_MPR121.git
cd Adafruit_Python_MPR121
sudo python setup.py install
```

Now download the code we've adapted for this tutorial:

```
git clone https://github.com/lesp/LXF_BananaGuitar.git
```

Change the directory to LXF_BananaGuitar and in the terminal open the file guitar.py with `sudo idle guitar.py`. We need to import the necessary libraries, in this case sys, time and pygame (which adds multimedia, gaming and sprites to Python). Next, import the MPR121 library. This is the chip that makes the capacitive touch possible.

```
import sys
import time
import pygame
import Adafruit_MPR121.MPR121 as MPR121
```

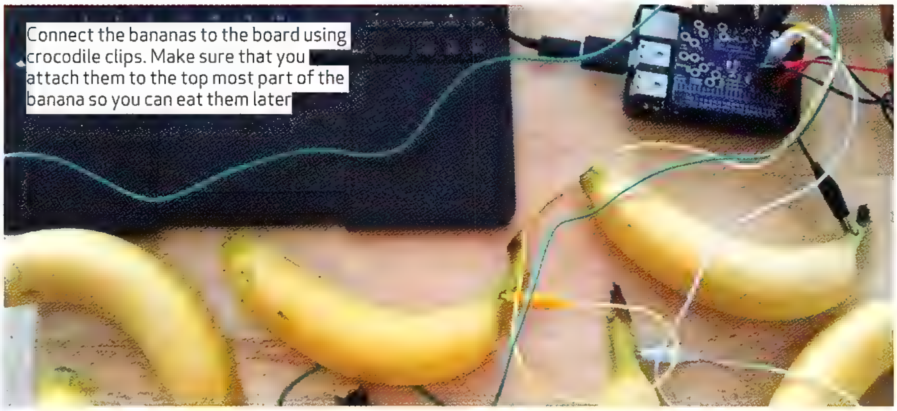
Next, we initialise the MPR121 and include an error-handling system in case of issues:

```
cap = MPR121.MPR121()

# default I2C address (0x5A). On BeagleBone Black will default to I2C bus 0.
if not cap.begin():
        print 'Error initializing MPR121.  Check your wiring!'
        sys.exit(1)
```

We then start Pygame's audio mixer and initialise Pygame:

```
pygame.mixer.pre_init(44100, -16, 12, 512)
pygame.init()
```



Connect the bananas to the board using crocodile clips. Make sure that you attach them to the top most part of the banana so you can eat them later

And create a library of sounds to use.

```
SOUND_MAPPING = {
   0: './1st_String_E.wav',
   1: './2nd_String_B_.wav',
   2: './3rd_String_G.wav',
   3: './4th_String_D.wav',
   4: './5th_String_A.wav',
   5: './6th_String_E.wav',
}
sounds = [0,0,0,0,0,0]
```

Now we set up how to play each sound in the library.

```
for key,soundfile in SOUND_MAPPING.iteritems():
        sounds[key] =  pygame.mixer.Sound(soundfile)
        sounds[key].set_volume(1);
```

Last, we create the structure that will constantly check to see if an input has been triggered:

```
last_touched = cap.touched()
while True:
        current_touched = cap.touched()
        for i in range(7):
        pin_bit = 1 << i
        if current_touched & pin_bit and not last_touched & pin_bit:
         print '{0} touched!'.format(i)
         if (sounds[i]):
         sounds[i].play()
         if not current_touched & pin_bit and last_touched & pin_bit:
         print '{0} released!'.format(i)
         last_touched = current_touched
         time.sleep(0.1)
```

Connect six crocodile clips from inputs 0 to 5 and attach the clips to the bananas. When ready run the code using 'Run > Run Module' and wait a few seconds before pressing the fruit. You should hear sound from the TV or connected headphones. Congratulations, you've made a banana guitar!

Touchy projects

Capacitive touch works by using conductive materials, such as fruit, tin foil and even water. The Adafruit Capacitive Touch HAT comes with a basic Python library that can be easily integrated into your projects. Have you ever wanted to make piano stairs? Where each step is an ascending or descending note? Well, now you can by using long crocodile leads and cardboard wrapped in tin foil to act as the conductor. Also you can use the HAT as an input for a photo booth, where the banana or other conductive materials can be used to trigger a camera to take your picture.

This board is still relatively new on the market and at the time of writing there are only a few resources provided with it, but the sheer brilliance of this board means that there will soon be lots of projects. The banana guitar project can also be undertaken with Pimoroni's Explorer HAT Pro board as it also uses capacitive touch input, and can work with four connected devices and four built-in buttons.

Raspberry Pi-powered disco

Get ready to strut your stuff on the dance floor. Create disco lights with the Unicorn HAT 8x8 RGB LED Matrix.

The Unicorn HAT is an add-on board for the Raspberry Pi Models B+, A+ and Raspberry Pi 2 that's an 8x8 grid of neopixel super-bright LEDs. The same type of LEDs are used to illuminate Blackpool Tower because of their low-power usage yet high brightness. We'll create two scripts to control your grid.

To install the Unicorn HAT on your Raspberry Pi, turn your Pi off and gently push the Unicorn HAT on to all of the GPIO pins until it's sitting firmly. Once done, plug in your peripherals, ensuring that you have an internet connection for your Pi, and then boot your Pi to the desktop.

Warning: The NeoPixel LEDs are extremely bright, protect your eyesight by using a piece of paper to diffuse the light. Now we need to install the software, for this we need to open an LXTerminal and type:

```
  sudo apt-get install
python3-pip python3-dev
  sudo pip-3.2 install
unicornhat
```

Keep the LXTerminal open and type `sudo idle3 &` to open the IDLE3 Python 3 editor with sudo powers, so that we can use the GPIO. With IDLE3 open we're immediately presented with the Python shell. This is where we can issue commands directly to Python. Go to the File menu and click on New to open a blank document. For our project we will create a changing colour sequence that will switch all of the LEDs from red to green and then to blue in an infinite loop. First, let's import the libraries that we need:

```
from time import sleep
import unicornhat as u
```

You can see that we've imported the sleep function only from the time library as this saves system resources. On the next line we import the Unicorn HAT library, and rename it u to make it easier to work with. Now we move to the main body of code and we contain this in a try-except structure:

```
try:
 while True:
  for i in range(8):
   for j in range(8):
```

Inside the try structure we use while True to create an infinite loop, and inside this loop we have two for loops: i and j. These contain a value from 0 to 7 that will control our x and y positions respectively in the LED grid. Now we create the actions that will happen while the for loop is working.

```
u.brightness(1.0)
u.set_pixel(i,j,255,0,0)
u.show()
sleep(0.01)
```

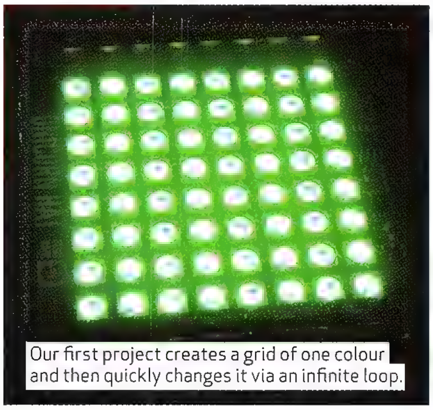
First, we set the brightness to full, which is 1.0 and set the pixel we are on to full brightness red using 255. The colours are handled by mixing red, green and blue as follows: 255,0,0 is red, 0,255,0 is green and 0,0,255 is blue. Next, we instruct the HAT to show the changes made and then wait for 0.01 seconds: We then halt the code for two seconds before moving to the next for loop to handle green and then blue.

The last section of code handles the user pressing 'Ctrl-C' to break the loop, which stops the code and clears the HAT. Save your code and run using the 'Run > Run Module' menu item. You will now see colours cycling on the screen.

For the full code, and an extension project, grab it from the LXFDVD or download the code examples from the GitHub (**github.com/lesp/LXF_UnicornHAT**).

For this project you will need

- A Raspberry Pi model A+ B+ or a Raspberry Pi 2 B
- Unicorn HAT (Pimoroni)


Our first project creates a grid of one colour and then quickly changes it via an infinite loop.

Our extension project creates a multicolour disco light using Unicorn HAT by using random numbers to generate values in our code.

NeoPixel powered

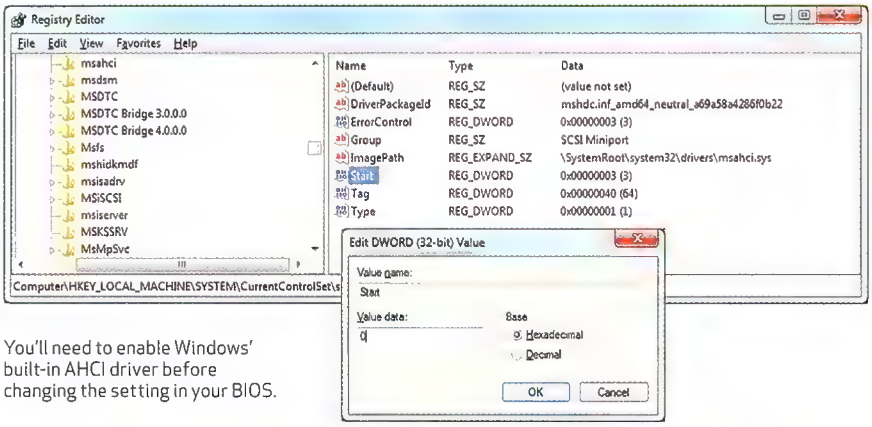
The Unicorn HAT was the first HAT board designed by Pimoroni for the Raspberry Pi model B+. The HAT (Hardware Attached on Top) standard uses an EEPROM (Electrically Erasable Programmable Read Only Memory) to communicate with the Pi and automatically configures the board ready for use. We recently had the chance to talk to Pimoroni about this board and they revealed that the board was developed to enable them to learn more about the new HAT standard. The pair also learnt about managing the power requirements for 64 LED, as, initially, the Unicorn HAT drew so much power that it reset the Raspberry Pi.

The LEDs on the Unicorn HAT are known as NeoPixels, or rather this is the name Adafruit uses, but their correct name is WS2812 Integrated Light Source and they are found on devices as small as name badges. Recently, hundreds of thousands of NeoPixels were integrated into Blackpool's famous Illuminations. ■

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.



Name	Type	Data
(Default)	REG_SZ	(value not set)
DriverPackageId	REG_SZ	mshdc.inf_amd64_neutral_a69a58a4286f0b22
ErrorControl	REG_DWORD	0x00000003 (3)
Group	REG_SZ	SCSI Miniport
ImagePath	REG_EXPAND_SZ	\SystemRoot\system32\drivers\msahci.sys
Start	REG_DWORD	0x00000003 (3)
Tag	REG_DWORD	0x00000040 (64)
Type	REG_DWORD	0x00000001 (1)

Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\s

Edit DWORD (32-bit) Value

Value name: Start

Value data: 0

Base: ● Hexadecimal ○ Decimal

You'll need to enable Windows' built-in AHCI driver before changing the setting in your BIOS.

WINDOWS
SURPRISINGLY, THE ORDER MATTERS

I recently upgraded my hard disk and reinstalled Windows 7. After doing some research online, I enabled AHCI in the BIOS, since the general consensus seemed to be that this was better than ATA. Except that now my PC won't boot. It just give an error saying 'boot drive inaccessible', or some such, and stops. I can change the BIOS back to ATA and it works OK, but I'd really like to switch to AHCI if possible.
Michael Stanmore

And quite right too, since the AHCI interface supports the TRIM command for SSDs, as well as other fun features like Native Command Queuing and hot-swapping. But you have to enable AHCI in the BIOS before you install Windows, otherwise the installer doesn't know to configure the boot loader to load the AHCI driver. You can fix that by booting in ATA mode and using regedit to locate the HKLM\System\CurrentControlSet\Services\Msahci key and set Start to 0. If you can't find this key in your registry, look for ...\Services\lastorV and make the same change. You can now reboot and change your BIOS settings back to AHCI and Windows will load the correct driver.
Luis Villazon

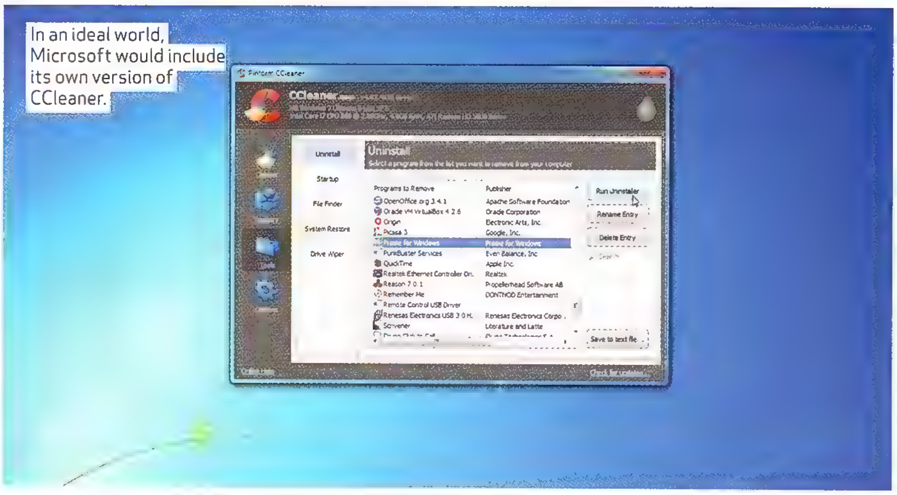
WINDOWS
WHAT ARE THOSE YELLOW THINGS?

I have been repairing and fixing Windows PCs (both mine and my friends') for many years, but there's one thing I am still a little puzzled about. When I'm deleting Registry items for programs that have been uninstalled, is it better to just delete the keys on the right hand side, or should I also delete the entire yellow folder on the left. Does it slow Windows down to leave the folders there? Is there any advantage?
Jim Savoy

Those folders are technically the Registry keys. The things on the right-hand side are called values. The key is a container for one or more values. Strictly speaking, leaving empty keys in the Registry will slow Windows down slightly because it will need to look inside each one when Windows starts, to confirm that there is nothing in them. But the difference is probably measured in milliseconds. The thing is, the performance penalty for leaving the entire key there is only very slightly larger. If it were significant, Microsoft would include its own version of CCleaner (**piriform.com/ccleaner**). Unneeded Registry keys are like the empty cardboard boxes in your roof. Yes, theoretically they count as clutter and you should sort them out one day, but the benefit isn't worth the risk of you losing your footing and falling through the ceiling into the bathroom below.
Luis Villazon

HARDWARE
CAN RAM LIMITS BE BROKEN?

I have an HP ProBook with 8GB RAM. I want to upgrade this to the maximum possible to run some very large numeric models for my uni studies. The manual says that it can be upgraded to 16GB but I wonder if it can go higher than this? At the moment I have 8GB in one slot and the other is empty, so adding another 8GB module would be 16GB



In an ideal world, Microsoft would include its own version of CCleaner.

There can be multiple causes for a blank monitor, including a faulty PSU, motherboard or even graphics card.

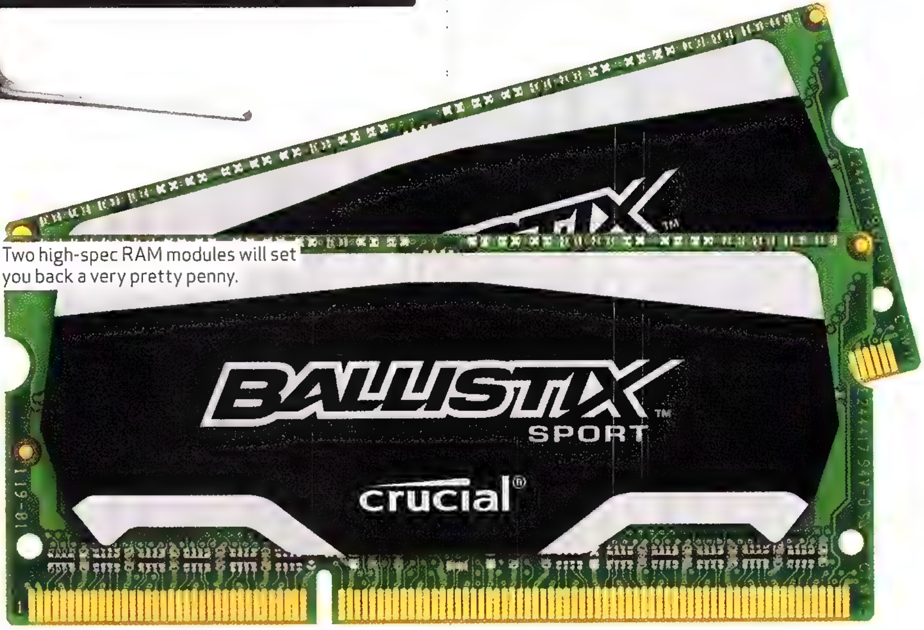
as they state. But if I threw out this module and added two 16GB modules, I would have 32GB. Would this work?
Diren Atalay

It would not. The maximum RAM for a PC isn't just the product of number-of-slots x biggest-module-you-can-buy. The motherboard needs to have enough address lines to support modules that big. Your HP ProBook sadly does not. We know this because your manual says so, and we've double confirmed it on HP's web site. 16GB modules are still new and very expensive, too – two would cost you about $800, which is around half the cost of the laptop. I can't believe your uni expects you to invest this much. Doesn't it have high performance workstations you can run your model on?
Luis Villazon

HARDWARE
IT'S DEFINITELY NOT THE PC

I have a problem with my monitor. The PC is fine because the fans spin and lights comes on. But there is no beep at startup from the monitor speakers and after a few seconds of black screen, the monitor goes into standby and stays there.
Heath Osborne

Spinning fans do not a working PC make. I could fill my garage with all the PCs I've owned that were capable of spinning their fans, but nothing else. (In fact I pretty much have filled my garage with them. I must have a clear out one day. It seems silly to leave the car rusting on the drive while 20 dead computers shelter from the rain.) That beep is supposed to come from the PC's internal speaker, not the monitor. You're not hearing it because the PC isn't booting. Why isn't it booting? Our guess: either the motherboard or the power supply has failed. If you haven't had the lid off recently, it's probably the PSU because this is the component most likely to break by itself.
Luis Villazon



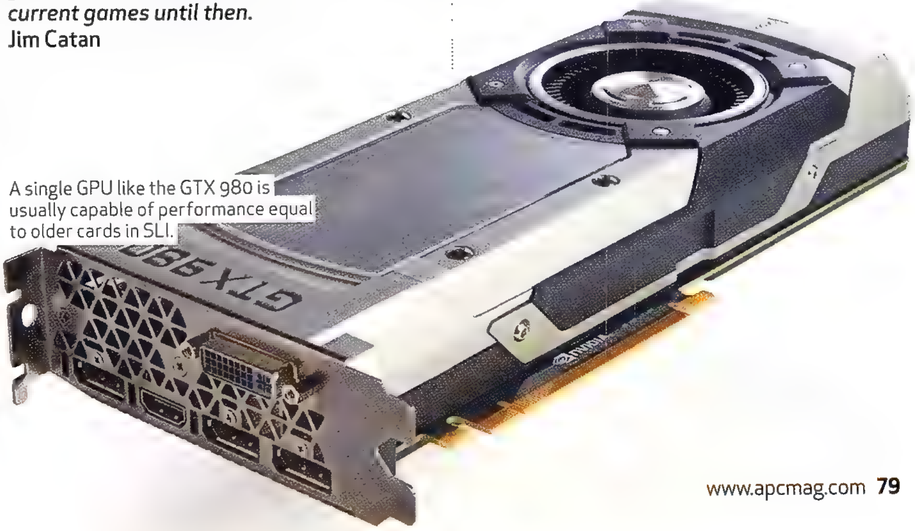
Two high-spec RAM modules will set you back a very pretty penny.

HARDWARE
ONE GPU OR TWO?

My system is about two years old. I've an EVGA GTX 670 superclocked 4GB videocard. It runs great and plays all the latest games with no issues. I'd like to buy another GTX 670 and run them in SLI. Currently I can buy a slightly used one for about $200 or new for $350. My system is an Intel Core i7-3770K, 32GB of Patriot memory, an ASUS P8Z77-V LE mobo, and a Samsung 256GB 840 Pro SSD running Windows 8.1. Should I buy the second GTX 670, or look into a GTX 980 instead? I'd like to keep this system at least two more years and want my video card to run current games until then.
Jim Catan

This is a tough call, but we'd probably stick with a second GTX 670 SLI as it will be very close to a GTX 980 in performance, and cost you a fraction of the price. Plus, since you have the 4GB version, you're all set for 4K gaming.

Of course, SLI has always been a bit more problematic to run than a single card, though both AMD and Nvidia have done a generally excellent job of providing driver profiles for AAA games the day of launch, so those concerns have gotten easier to deal with. Perhaps the biggest question is whether you can handle double the heat and noise in your case, and whether your power supply is capable of running SLI? These are all issues that SLI-runners must deal with, which is why many people just want to run a single GPU, as there are zero hassles taking that route. If you decide a single card is your future, but you're on a budget, consider the Maxwell-based GTX 970 as it's a good option for around $450. It will offer probably about the same performance as your dual cards, with less than half the noise and heat.
APC staff



A single GPU like the GTX 980 is usually capable of performance equal to older cards in SLI.

Customise the Windows 8.1 Lock screen

Get your screen looking just the way you want, with **Matt Hanson**.

The Lock screen is the first thing you see in Windows 8.1, and it should be the first thing you make your own. Fortunately, there's a whole heap of ways you can do just that, from changing the image and colour on show, to the type of information updates you receive. You can even set up picture passwords. Likewise with the login screen. From playing around with accessibility, to personalising your profile picture, there's no reason why your PC experience shouldn't start out exactly how you'd like it to. Read on to find out how.

1 CHANGING THE IMAGE

The standard Lock screen looks pretty enough, but it's even better if you change the picture. Press Windows-i, click 'Change PC Settings', and open the Personalization menu. The first things you see are your options for replacement images. You don't have to stick with the classy images that Microsoft has provided. You can use a picture of your other half, cat, or favourite pot plant on the Lock screen instead – just click the Browse button and choose the image you want to use from now on.

2 EXTRA INFORMATION

At the bottom of the Lock screen you'll see a few quick updates about what's happening on your PC. You can view more than this, though. On the Personalize screen, you'll find options that enable you to change the specific icons that get displayed. Certain apps – Calendar and Weather, by default – can show you more information on the Lock screen [Image A]. Just make sure the app you're interested in is highlighted at the very bottom of the Personalize page of Control Panel.

You can take the Lock screen further with third-party apps. Search the Windows Store for Incredilock. It's free, offers customisable wallpapers, and can add things, such as to-do lists, to your Lock screen. Many apps can add information to your Lock screen beyond those that are installed by default. Hunt through the Windows Store and you should be able to find plenty of apps that you can configure to display useful information at lock; here we're talking about Twitter clients, third-party weather apps, and more.

3 PICTURE PASSWORDS

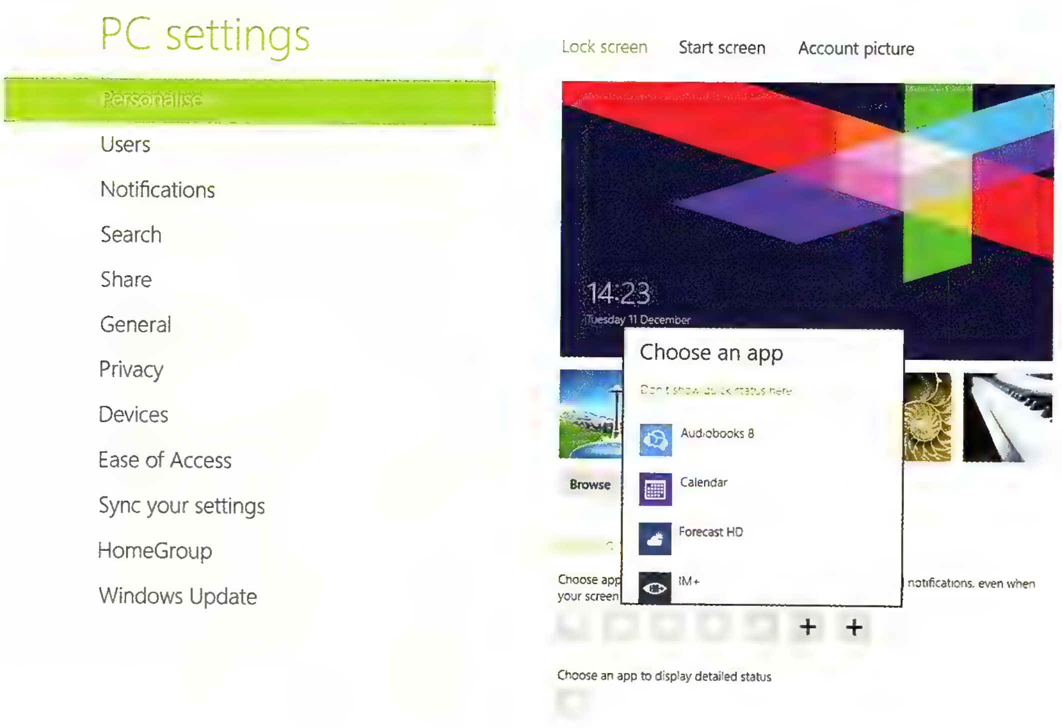
Open up the Start screen control panel and go to the Users tab. Here you can change your login password. Note that changing this also changes it for other machines or services (such as Outlook mail) that your account is linked to. You should try the picture password function on the Users tab of 'Change PC Settings'. It's a fun way to log into your PC, and it's pretty secure, too. Just try not to leave telltale smears if you're using a touchscreen device.

4 FAST LOCK

Want to bring the Lock screen up in a flash if, for instance, you're stepping away from your PC for a while? Easy. Either click your profile picture in the top-right corner of the Start screen and click Lock, or just press Windows-L at the same time.

5 SCREEN COLOURS

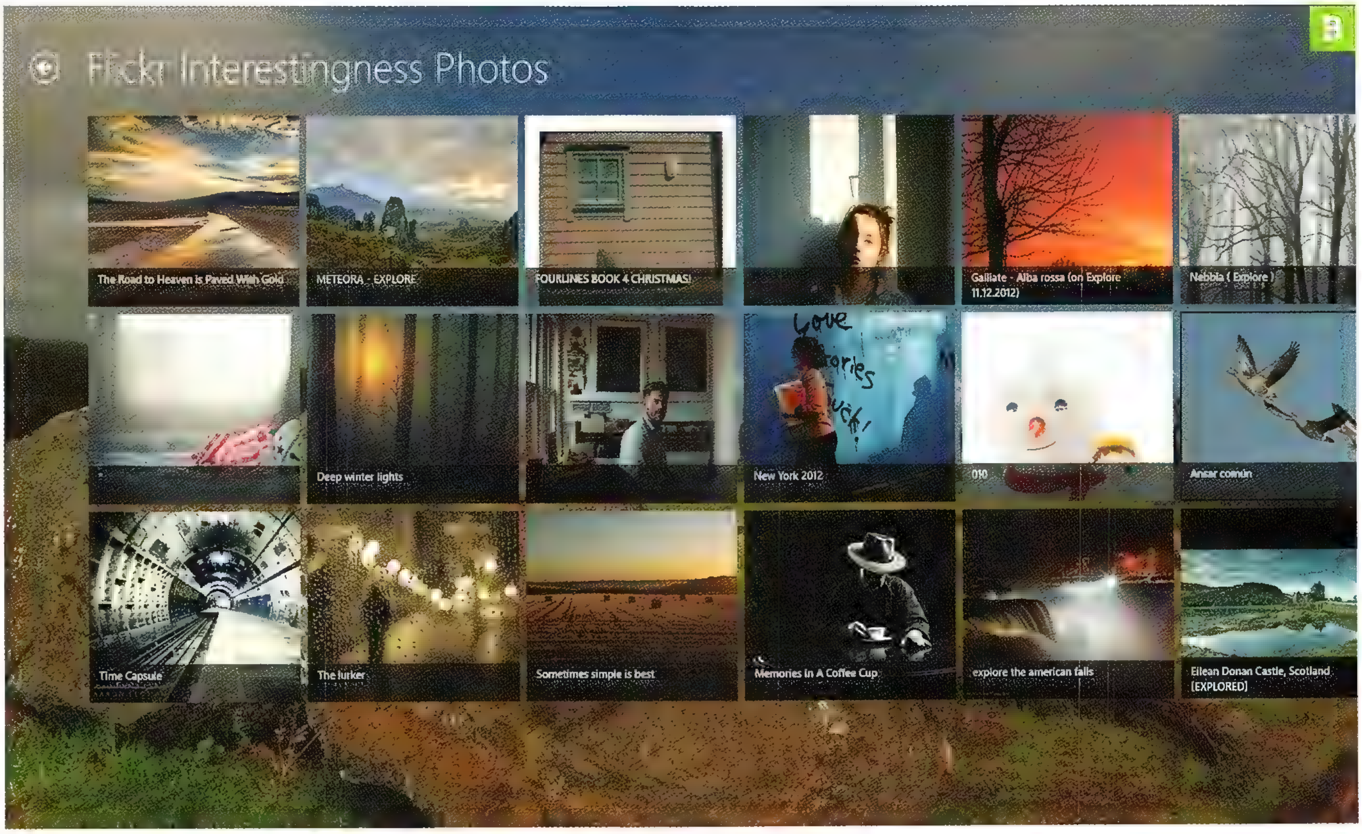
You can customise your Lock



Choose app… your screen… notifications, even when

Choose an app to display detailed status

A


B
Flickr Interestingness Photos
The Road to Heaven is Paved With Gold
METEORA - EXPLORE
FOURLINES BOOK 4 CHRISTMAS!
Galliate - Alba rossa (on Explore 11.12.2012)
Nebbia (Explore)
Deep winter lights
New York 2012
010
Ansar comoin
Time Capsule
The lurker
Sometimes simple is best
Memories In A Coffee Cup
explore the american falls
Eilean Donan Castle, Scotland [EXPLORED]

screen colours separately from your Start screen colours. Open the desktop, hit Windows-r, type `regedit`, and go through HKEY_LOCAL_MACHINE, SOFTWARE, Microsoft, Windows, CurrentVersion, Explorer, and then Accent. Right-click on Accent and create a new Dword, which we suggest that you call "DefaultColorSet." Now edit this, switch the base to decimal, and set this to be a number between 0 and 24.

6 HIDE SCREEN

If you want to ditch the Lock screen altogether, then hit Windows-r, type `gpedit.msc`, go to 'Computer Configuration › Administrative Templates › Control Panel › Personalization', and change the option 'Do not display the lock screen' to Enabled.

7 AUTO IMAGE UPDATE

Add some pep to your Lock screen by automatically changing its image. Search the Windows Store for Chameleon. This pulls in photographs from sources such as the National Geographic and Bing, and pastes new ones on your Lock screen at set intervals [Image B]. Another option for shuffling is Lockerz. This app works by either displaying a selection of your local pictures that you've chosen, or it can be hooked up to your OneDrive account for a truly personal random experience.

8 ONTO THE LOGIN SCREEN

If you just want to get past the Lock screen, to the login screen, there are loads of ways to do that – click it, drag it up, spin your mousewheel, or hit Space to progress. You see your account picture on your login screen. Or you might not. If you've not set one up, you will just see a silhouette. Go to the Users menu in 'Change PC Settings' to add a picture. This will follow you anywhere you use your Microsoft login.

9 ACCESSIBILITY OPTIONS

The login screen has a neat feature for visually impaired users in the bottom-left, so you can turn on narration, the magnifier, and more, before you log in. Press Tab, then Enter, if you want to get there without clicking. You can also use the accessibility dialog to turn on the onscreen keyboard. It's really useful on touchscreens and for those who can't use a keyboard.

10 QUICK SHUTDOWN

Log out! Shut down! Do it all without logging in. There's an icon at the bottom-right of the login screen that does the job. Access it by tapping Tab, Tab, then Enter, before selecting the function you want with the arrow keys.

11 SHORTCUTS

Once you've logged in, you might want to try getting around the Start screen using nothing but your keyboard. This can be done by using the arrow keys to flick between icons, and Enter to run your selection. Jump through the Start screen by using Page Up and Page Down to hop to either end, or use Tab to jump straight up to your profile picture.

12 MOUSE CONTROL

You can also use the mouse wheel to scroll through your Start screen, particularly if you have a lot of items on there. It is the quickest way to see everything. If you find the amount of apps intimidating, don't worry, simply start typing the name of the app you're looking for and it appears on the right.

13 ALL APPS

Don't forget the 'All apps' menu, which shows everything, not just those apps you've got pinned to your Start screen. Right-click on the Start screen and choose its icon. Right-click any of the apps in the 'All apps' screen and select 'Pin to Start' to make them visible on the Start menu.

14 SWITCH ACCOUNTS

Many people can use the same machine. If you've set up more than one in the Users tab of the 'Change PC Settings' screen, just click your profile picture to switch accounts. ■

iPad edition

iPad
9:41 AM
NETFLIX
NETFLIX IS HERE!
BUT WHICH VIDEO SERVICE IS RIGHT FOR YOU?
AUSTRALIAN
T3
Tomorrow's Technology Today
Winter 2015 / $9.95
FROM TRAILBLAZING TECH
TO THE TALENT BEHIND IT,
T3 REVEALS THE GADGETS
YOU NEED RIGHT NOW!
iWRIST
APPLE WATCH
WAS IT WORTH THE WAIT?
Future
HOT
100
POWERFUL PORTABLES
THE FASTEST PHONES EVER!
THE SHARPEST NEW SHOOTERS

INTELLIGENT
INTERACTIVE
INNOVATIVE

ENHANCED DIGITAL FEATURES!

Stream trailers and exclusive videos

Access bonus digital-only content

Tap hotspots for detailed product info and extras

Access articles with improved navigation

NEW ISSUE

Available on the App Store

Apple, the Apple logo and iPad are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

Working with symbols and Word VBA

Helen Bradley shows how to identify and insert symbols into documents using Word VBA.

There are lots of unique symbols buried inside fonts which you can insert into a Word document using the Symbol dialog. These can also be inserted using macros in Word. This month we show you how to find these symbols, how to identify their character codes, and how to insert them into a document using VBA.

Almost any character in any font can be added to a document if you know its character code. Our first macro identifies the font and character code of the currently selected symbol in a Word document.

This macro uses the Insert Symbol Dialog to get the character code and the font name for a symbol. However, only symbol fonts can be identified this way and fonts such as Arial and Calibri are only identified as (normal text). The final part of this macro uses the Selection.Font.Name property to get the font name if the font is not a symbol font. Add this macro to a Module in the VBA Editor and then select a symbol in a document and run the macro to get its font name and character code:

```
 Sub
DisplayFontAndCharacterNumber()
 With
Dialogs(wdDialogInsertSymbol)
     FontFaceName = .Font
     FontCharNumber =
"Character number is:  " & .
charnum
 End With
 If FontFaceName = "(normal
text)" Then
     FontFaceName = Selection.
Font.Name
 End If
 MsgBox "Font is: " &
FontFaceName & vbCrLf &
FontCharNumber
 End Sub
```

> "Once you know the font and character code you can add the symbol to a document using a macro."

Once you know the font and character code you can add the symbol to a document using a macro. This following macro inserts a left triangle symbol (code -3965) from the Wingdings 3 font. Note that it isn't unusual for codes to be quite large values or negative values and, although they are numeric, they must be specified as strings in the macro. Make sure to type the font name correctly – if it is not correct you may get unexpected results.

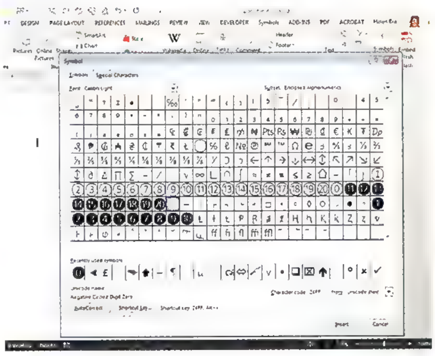
```
 Sub
InsertLeftTriangleSymbol()
 Selection.InsertSymbol
Font:="Wingdings 3"¬
CharacterNumber:="-3965"¬
Unicode:=True
 End Sub
```

FINDING INTERESTING SYMBOLS

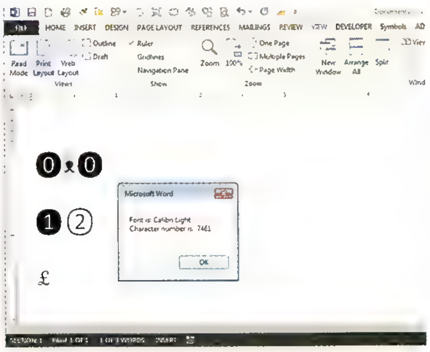
To access a wide variety of symbols in Word, from the Insert tab choose 'Symbol > More Symbols' and select Unicode (hex) from the dropdown list in the bottom right of the dialog.

Insert a character into your document, run the macro DisplayFontAndCharacterNumber to determine the character code to use for it and you can then adapt the macro so you can insert it into a document using that macro in future. ■

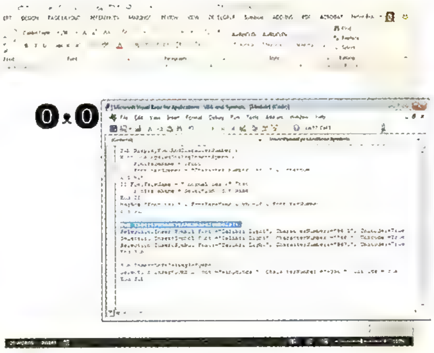
Creating code to insert symbols



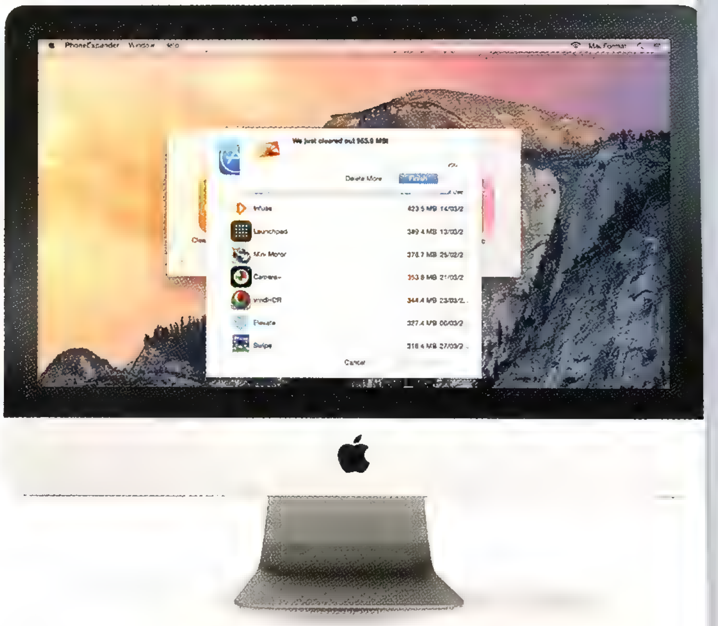
1 STEP 1
Download the code from **www.apcmag.com/magstuff** and locate symbols to use via the Symbol dialog in Word.


Microsoft Word
Font is: Calibri Light
Character number is: 7461

2 STEP 2
Run the macro to identify the character code (and optionally the font) of the symbol.



3 STEP 3
Customise the macro so you can insert the symbol into a document anytime in the future using VBA



Reclaim iPhone storage space

Craig Grannell shows you how to get back storage on your iPhone or iPad with PhoneExpander for Mac.

Modern technology continues its inevitable shift towards appliance-style devices. Gone are the days when you could easily open up and tinker with hardware, expanding and customising it. Today, this thinking tends to stop with a snazzy sleeve or something you can plug into something else. And that's OK. There's nothing wrong with hardware that works well, and where the user doesn't have to fret about maintaining anything beyond occasionally prodding 'OK' when asked to update some software.

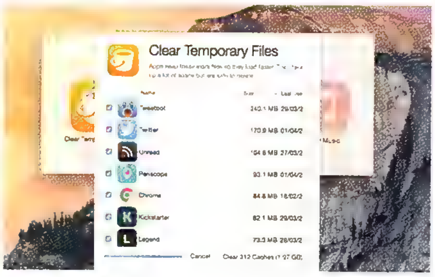
There is one major exception, however, and that's storage. No iOS device is expandable, and so you're stuck with whatever you plumped for when purchasing your phone or tablet. At the time, 16GB might have seemed plenty, but iPhones and iPads soon fill up once you start installing apps and games, shooting photos and videos, and even when using certain apps a lot. Social networking apps, for example, have a tendency to bloat from their initially tiny download sizes, primarily because they cache imagery and video for convenient playback later.

PhoneExpander (which, despite its name, works fine with the iPad and iPod touch) is a quick fix for gaining back chunks of space on your device. The version we used was a beta, so might differ slightly from what you see when reading this; what won't change is the app's speed, efficiency and results.

Go to **phoneexpander.com** to find out more and download the app to your Mac. (There's sadly no Windows version available as yet.) To get cracking with our step-by-step walkthrough here, simply plug in your device using your USB cable and launch the app.

Top three features

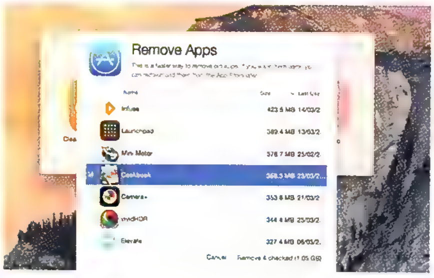
Clear some space with PhoneExpander.



Tweetbot	240.1 MB	29/03/2
Twitter	170.9 MB	01/04/2
Unread	164.6 MB	27/03/2
Periscope	93.1 MB	01/04/2
Chrome	84.8 MB	18/02/2
Kickstarter	82.1 MB	29/03/2
Legend	73.3 MB	28/03/2

TRASH TEMP FILES

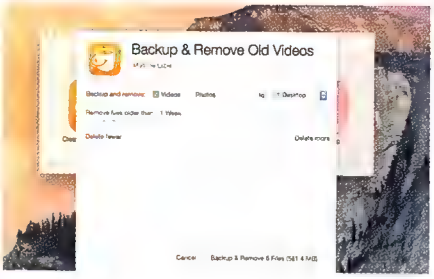
1 Click on 'Clear Temporary Items'. PhoneExpander will build a list of caches on your device that can be removed. To get rid of them all, click the Clear button (which will denote the space saving). To be more selective, use the checkboxes before clearing the caches. Once you're done, a sheet will advise you regarding how much was cleared, enabling you to continue (Delete More) or Finish.



Infuse	423.5 MB	14/03/2
Launchpad	389.4 MB	13/03/2.
Mini Motor	376.7 MB	25/02/2.
Cookbook	368.3 MB	23/03/2...
Camera+	353.8 MB	21/03/2
vividHDR	344.4 MB	23/03/2.
Elevate	327.4 MB	06/03/2.

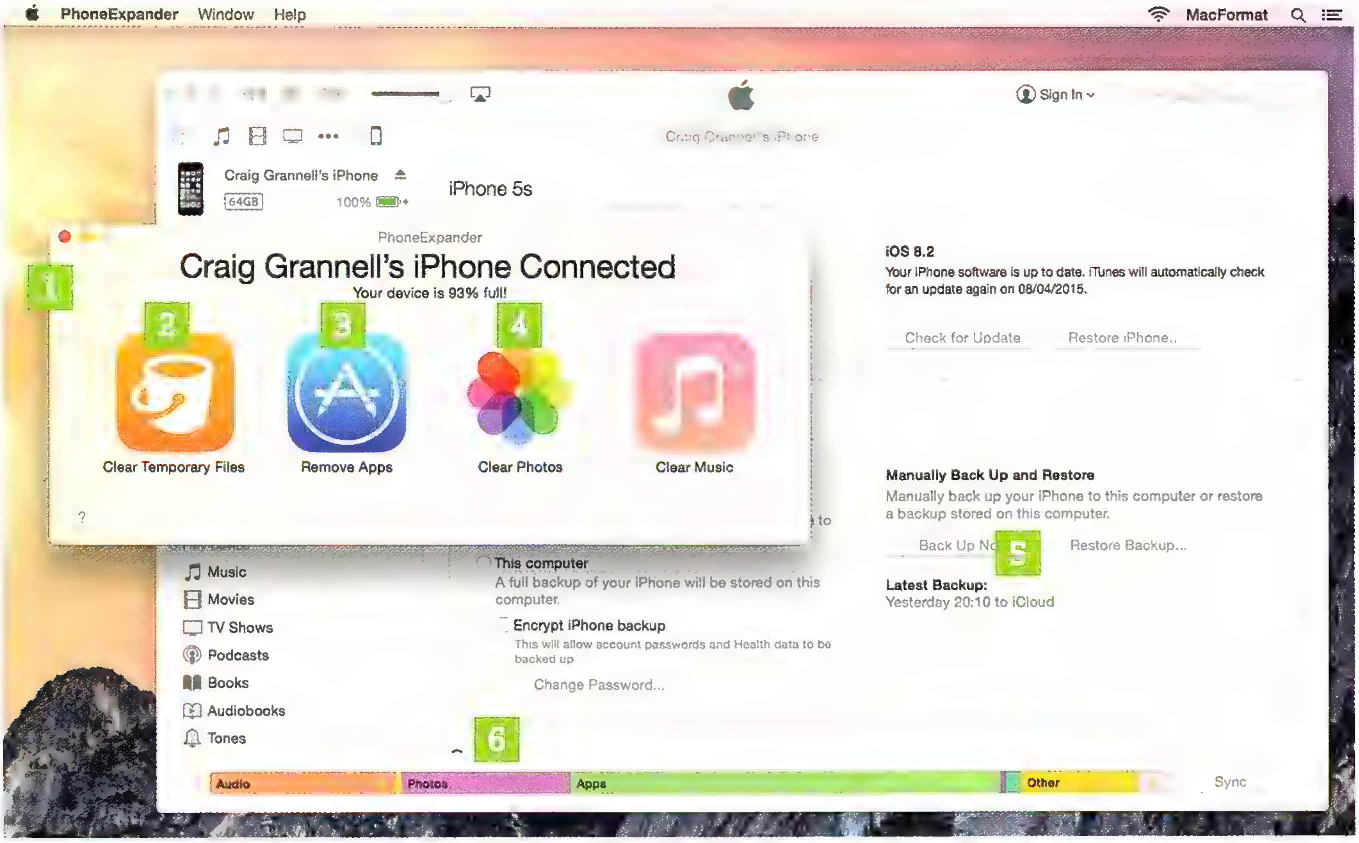
REMOVE WEIGHTY APPS

2 Click 'Remove Apps'. Again, PhoneExpander will create a list of relevant items on your device. Apps are initially listed from largest to smallest. As with the temp files, removal is simple: select one or more items then click the Remove button. Note that in removing apps from your device, you will also remove all associated data and settings at the same time (unless the app stores such things in iCloud).


Backup & Remove Old Videos
Backup and remove:
☑ Videos
Photos
Desktop
Remove files older than 1 Week
Delete fewer
Delete more
Cancel
Backup & Remove 6 Files (561.4 MB)

DELETE OLD VIDEOS

3 Click 'Clear Photos'. The interface here is different from the others, in that it gives you a slider to determine the age of what you want to remove. Drag the slider left to include older (and therefore, likely, fewer) files. Use the checkboxes to select whether to remove videos and/or photos, then use the menu to determine where the backups of removed files go. Click 'Backup & Remove…' to complete the process.


PhoneExpander
Window
Help
MacFormat
Sign In
Craig Grannell's iPhone
64GB
100%
iPhone 5s
PhoneExpander
1
2
3
4
5
6
Clear Temporary Files
Remove Apps
Clear Photos
Clear Music
Check for Update
Restore iPhone...
Back Up Now
Restore Backup...
Change Password...
Music
Movies
TV Shows
Podcasts
Books
Audiobooks
Tones
Audio
Photos
Apps
Other
Sync

Craig Grannell's iPhone Connected

Your device is 93% full!

iOS 8.2

Your iPhone software is up to date. iTunes will automatically check for an update again on 08/04/2015.

Manually Back Up and Restore

Manually back up your iPhone to this computer or restore a backup stored on this computer.

Latest Backup:
Yesterday 20:10 to iCloud

This computer
A full backup of your iPhone will be stored on this computer.

Encrypt iPhone backup
This will allow account passwords and Health data to be backed up

VISUAL GUIDE

SAVING SPACE WITH PHONEEXPANDER AND ITUNES.

1 USING PHONEEXPANDER

On launching PhoneExpander, you'll see your device's name and how full it is. When devices get too full they run into problems, such as not being able to download and install large apps, and possibly not being able to update iOS. Once you get in the higher end of 90% it's time start deleting things. (Depicted here is Craig's iPhone after already having done a couple of rounds of PhoneExpander testing — it was even more full before!)

2 TEMPORARY FILES

Apps often use temporary files, to load more quickly or appear more responsive. Most are small and best left alone. But some apps have monster caches that are worth deleting if you're very tight on space. Be mindful caches will likely rebuild when you subsequently use an app, and that temporary files for Newsstand apps are mostly magazines. Delete them and you'll need to redownload.

3 APP REMOVAL

Apps can be massive, especially games and music ones. The size you see on the App Store is the download — apps can then take up significantly more space as assets expand. Although you can of course remove apps using only your device, PhoneExpander is much faster when dealing with multiple apps — you don't need to make the icons jiggle then delete them one by one.

4 PHOTOS AND VIDEOS

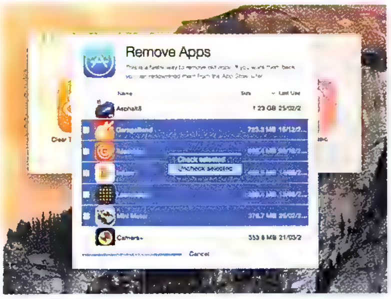
Newer iOS devices have great built-in cameras but higher-quality photos, and especially videos, rapidly eat into your storage space. Regular iPhoto (and, we presume, Photos for OS X) imports can offload video, but PhoneExpander is fast, quickly removing content from your device, and enabling you to later import it into your favoured app. Whatever you do, though, don't delete videos if you're tight for space — back them up instead.

5 ITUNES BACK-UPS

Although we had no problems with PhoneExpander, we recommend you back up your device before using it, just in case. You can back up to iCloud, but since you're plugging in your device via USB anyway, also back up to iTunes. Select your device, click 'Back Up Now' and iTunes will get to work. This backup will be stored on your Mac, and can later be used to restore a device if needed.

6 SEEING WHAT'S WHERE

Another reason it's worth checking in with iTunes is because it gives you a handy bar chart that outlines what's taking up space on your device. If you've got few apps but tons of audio, it might be worth cutting back on albums. But if apps or videos are taking up the majority of storage, pruning them with PhoneExpander could be smart. ('Other' mostly comprises temporary files.)


Remove Apps
Check selected
Uncheck selected
Cancel

All in order

Two of PhoneExpander's sheets helpfully enable you to reorder items by name, size or last use.

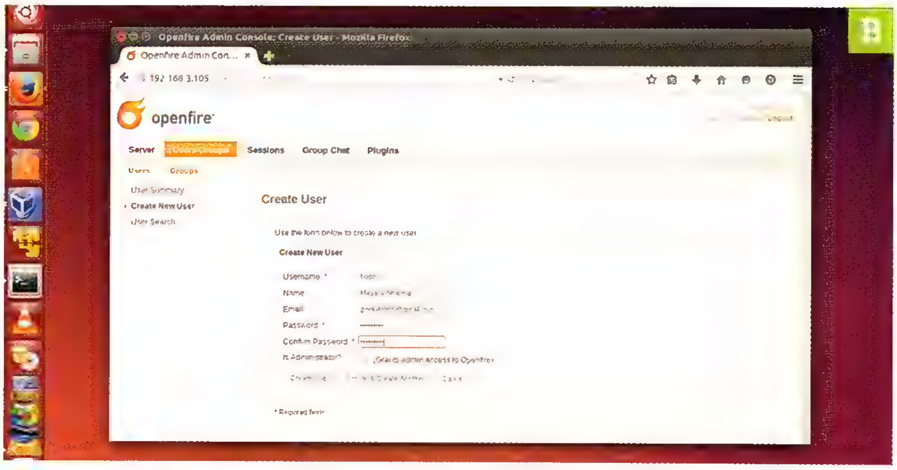
Last use is handy for unearthing possibly large apps and games you haven't launched in ages, and therefore could probably get rid of without any problems. Note that you can also easily select or deselect ranges of items in such lists — to do so, click an item and then Shift-click another. Control-click and then choose 'Check selected' or 'Uncheck selected', depending on your requirements.

Host your own instant-messaging server

Chat with your friends! Mayank Sharma shows you how.

Instant messaging, or IM, is one of the best collaboration tools on any type of network. Educational institutes can use it to connect teachers with each other, as well as the students, or it can even bring together geographically displaced employees of a multinational corporation.

The Extensible Messaging and Presence Protocol, or XMPP, is one of the most popular protocols for powering an IM server – it currently serves millions of users worldwide and is also used by Google Talk. There are several XMPP-based IM servers available, but Openfire is one of the easiest to set up and use, implementing many of the commonly used functions of the XMPP protocol and scaling well. On small-scale deployments, the server can manage and support users by itself. On larger deployments, you can hook up Openfire with existing network infrastructure such as an LDAP server and offload storage to an external database server. While you can use any XMPP-compatible IM client to chat through Openfire, it works best with its own feature-rich Spark client. Here's how to set it up.



B

Create User

Use the form below to create a new user

Create New User

Username *

Name

Email

Password *

Confirm Password *

Is Administrator? (Grants admin access to Openfire)

* Required fields

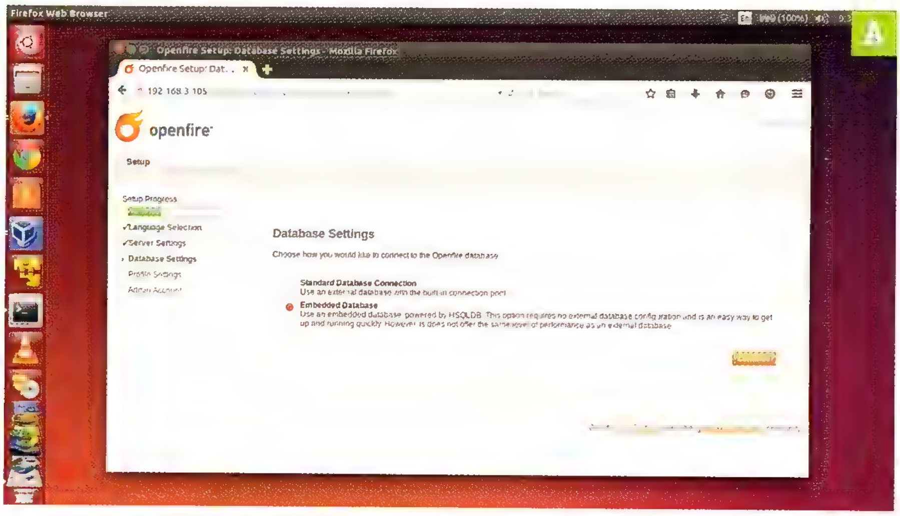
PREPARE TO OPENFIRE

The Openfire server can be deployed on Windows, Mac OS X, and on various Linux distros, including Debian, Ubuntu, and Fedora. The latest version is Openfire 3.9.3. In this tutorial we'll deploy it on top of an Ubuntu Server installation.

- Before you can install Openfire, make sure your Ubuntu server has the latest Java Runtime Environment (JRE) that you can install from Ubuntu's official repository with `sudo apt-get install openjdk-7-jre`. This step isn't required if you're installing Openfire on Fedora, Windows, or Mac because the binaries for these platforms already include the Java JRE.

COMMAND AND CONTROL

Once it's installed, download the .DEB binary of the latest version of the server – namely "openfire_3.9.3_all.deb" – from its web site and install it with `sudo dpkg --install openfire*.deb`. That's all there is to it. The Openfire server is now installed and you can control it via the scripts that have been placed inside the "/etc/init.d" directory. You can start the server with `sudo /etc/init.d/openfire start`. Similarly, to stop the server use `sudo /etc/init.d/openfire stop`.



A

Database Settings

Choose how you would like to connect to the Openfire database

Standard Database Connection
Use an external database with the built-in connection pool

● Embedded Database
Use an embedded database powered by HSQLDB. This option requires no external database configuration and is an easy way to get up and running quickly. However, is does not offer the same level of performance as an external database

- Once the server is up and running, you can configure and control it from a remote machine via its browser-based interface, which you can access by pointing your web browser to port 9090 on your server. For example, if the Openfire server is on a machine with the IP address 192.168.3.100, then Openfire's web interface is at http://192.168.3.100:9090.

CONFIGURATION WIZARD

The first time you bring up the interface, you'll be taken through a five-step set up wizard. After selecting the language, you'll be asked to tweak basic server settings such as the domain name. You should also change the default ports for accessing the administration console. For added security you can also encrypt system properties by selecting one of two options (Blowfish and AES) and specifying a key.

- In the next step you're asked to select a database for storing information such as user profiles and offline messages [Image A]. If you're deploying Openfire on a small network, you can choose to use the built-in HSQLDB, which doesn't require an external database server. However, if you'll be servicing hundreds of users, you should opt to connect to an external database.

USER MANAGEMENT

You're then asked to select a mechanism for fetching user authentication information. Unless you've a directory server already managing users, you should use the default option which entrusts user management to Openfire.

- In the final step you're asked for the email address of the administrator along with the password for accessing the admin interface on subsequent visits. Your Openfire server is now ready to accept connections and facilitate communications inside your network.
- If you haven't changed the port of the admin interface, you can manage the server by heading to the same address as before. Instead of the configuration wizard, you'll be greeted by a login page. Enter the username (admin) and the password you specified in the last step of the configuration wizard to access Openfire's admin interface.

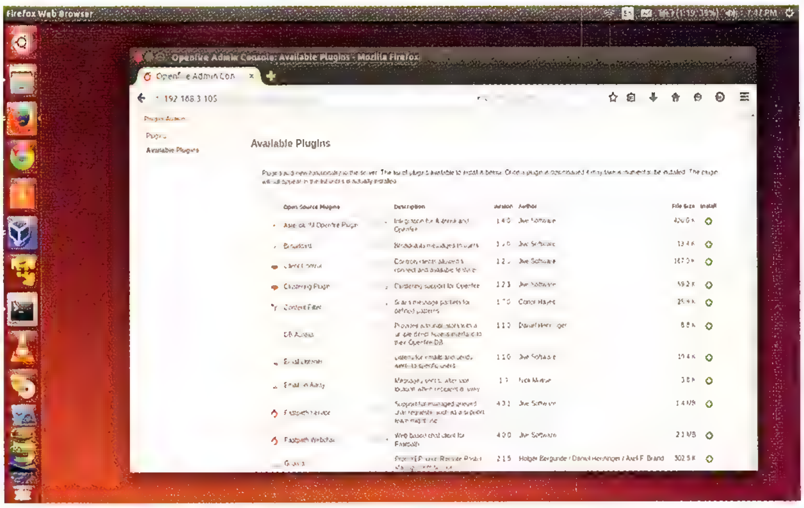
INTERACTING WITH THE SERVER

Now the server's set up, you can connect to it using an IM client from any computer on the network. Like Openfire, its companion Spark client is also available for multiple platforms and distros, including Windows and Mac OS X. For Ubuntu, you'll have to download the latest version as a compressed tarball and extract it with `tar xvf spark_2_6_3.tar.gz -C /opt`. There's no installation and once it's extracted you can launch the client with `/bin/bash /opt/spark/Spark`.

- Spark requires 32-bit Java, so if you're on a 64-bit machine and get errors about missing libraries you can install them individually, or you can install 32-bit JDK `sudo apt-get install openjdk-7-jdk:i386`. In the client, enter the login credentials of the admin user and enter the IP address of the Openfire server in the Server field, and click Login.
- You can also connect to Openfire using other multi-protocol IM clients such as Pidgin. In addition to the login credentials and the IP address of the server, you'll also have to make sure the client uses the XMPP protocol to connect to Openfire.

POPULATE ROSTERS

Your contacts list is empty because there aren't any users on the server besides you, the admin. There are two ways you can add users – either via the web-based admin console or from within Spark. If you prefer the first route, head to the Users/Group tab. To create a new user click on 'Create New User' and fill out the details [Image B]. To better organise users you can also categorise them under groups. To define groups, switch to the Groups tab and click on 'Create New Group'. Users can also register themselves with the Openfire server from the Spark client by clicking on the Accounts button and filling out their details [Image C].



Upgrade with plugins

While it's loaded with features, you can extend Openfire and infuse new functionality by adding plugins.

The default Openfire installation ships with over 20 plugins that have been thoroughly tested.

There are plugins that add useful features such as the ability to broadcast messages to all users and to filter messages based on their content. Then there are plugins that help hook up Openfire to existing services on the network, such as the Asterisk PBX or an email server. When connected to an email server, Openfire will alter users on any incoming emails.

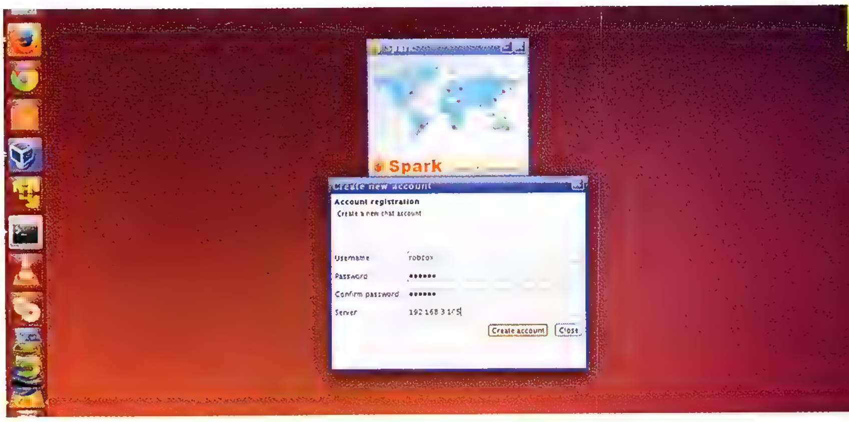
One interesting plugin we've used in this tutorial is Kraken IM Gateway. It helps users connect to public IM services such as Facebook and Google Chat.

To enable a plugin, log into the web admin console and head to 'Plugins > Available Plugins' to view the list of all supported plugins. Each one has a brief description and buttons to view its 'readme' file and 'changelog'. To install a plugin simply click the green '+' button next to it.

- Once you've added users and defined groups, you can use this information to populate their rosters. A roster in XMPP parlance is a friends list. With Openfire's roster sharing feature, all your users will have their co-workers already in their contact list as soon as they log in. You'll need a categorised list of groups and users for this feature to work. It doesn't matter whether you've got this information from a directory server or have created it manually in the administration interface.

SHARING CONTACTS

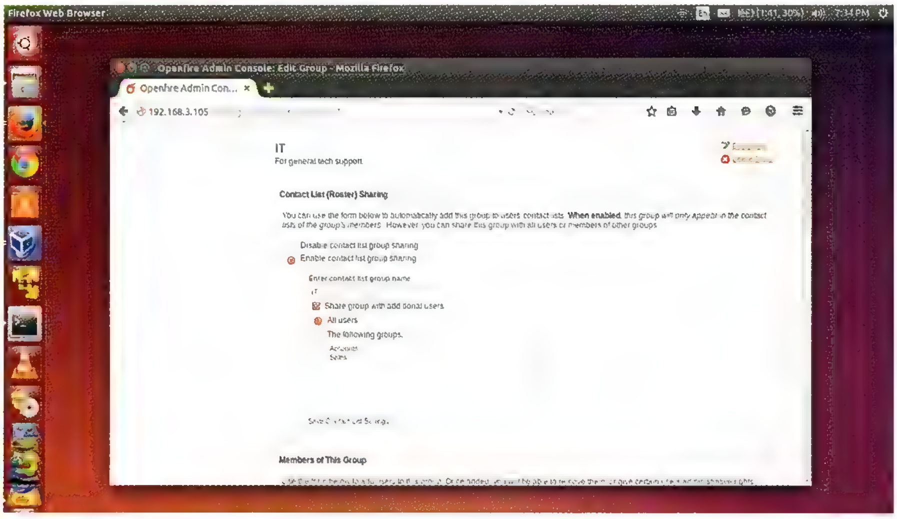
To allow members of each group to see each other, log in to the web interface and head to the Users/Groups section. Switch to the Groups section and select any group from the list. This opens the page for editing the settings of that particular group. Scroll down to the 'Contact List (Roster) Sharing' section and toggle the Enable contact list group sharing option, then enter the name of the group in the text box. Now save the settings and repeat the procedure for all the groups on your server. Once



Account registration
Create a new chat account

Username robtox
Password ••••••
Confirm password ••••••
Server 192.168.3.105

C



IT
For general tech support

Contact List (Roster) Sharing

You can use the form below to automatically add this group to users' contact lists. **When enabled**, this group will only appear in the contact lists of the group's members. However, you can share this group with all users or members of other groups.

○ Disable contact list group sharing
● Enable contact list group sharing

Enter contact list group name
IT
☑ Share group with additional users
● All users
○ The following groups:
Accounts
Sales

Members of This Group

you're done, members of a group will automatically have each other in their contact list.

- Additionally, there are certain users, for example the guys from the IT department, who you might want in everyone's roster. To do this, enable roster sharing for them just like above. But before saving the settings, toggle the 'Share group with additional users' checkbox and select the 'All users' option [Image D]. Now all users in every group will have users from IT in their contact list.

ADDING OTHER IM NETWORKS

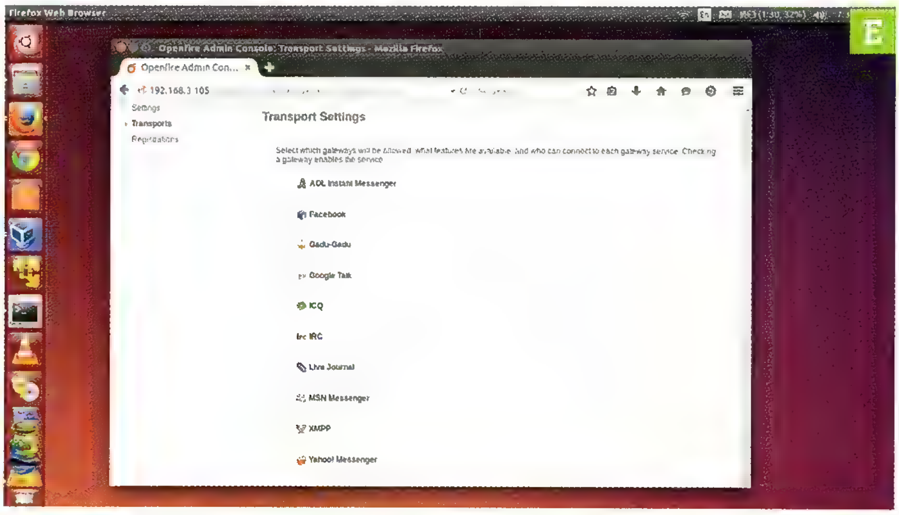
By default the Openfire server facilitates communication between users registered with it. But you can also interact with users on other public IM networks such as Yahoo, Facebook, and Google Talk. For this functionality, you need to enhance Openfire by adding the Kraken IM Gateway plugin that allows users to connect to their accounts on external services.

- Begin by installing the plugin. Once installed, it creates its own entry called Gateways under the Server section in the web admin panel.
- Using it is straightforward. To allow users to connect to a third-party IM server, head to 'Gateways > Transports'. This section lists all the supported IM services [Image E]. When you select a service it slides open a small bar at the bottom with three buttons that'll help you configure and test the gateway. You can access some settings specific to a gateway using the Options slider button. However, unless you're having trouble connecting, the default settings should work without any modifications. You can test the settings using the Tests slider button.

SETTING PERMISSIONS

By default, all users on the Openfire server will be able to connect to the enabled gateway service. To restrict access to certain users or a particular group, you need to head to the Permissions option. Here you get options to choose the users and groups you wish to connect to external services. You can also restrict the gateway to only users you've added manually.

- You can enable as many different gateways as you wish to choose, with different permission settings for each. For example, you can enable Google Talk for all users and IRC for just the IT group. Icons for enabled services appear in the user's Spark client. They can then click on the icon and enter the login credentials for the service to connect to it. ■



Transport Settings

Select which gateways will be allowed, what features are available, and who can connect to each gateway service. Checking a gateway enables the service.

AOL Instant Messenger
Facebook
Gadu-Gadu
Google Talk
ICQ
IRC
Live Journal
MSN Messenger
XMPP
Yahoo! Messenger

Put into production

There's a couple of things to consider when you're ready to roll Openfire out into a live production environment. You'll have to tweak your firewall, for example, to allow Openfire traffic.

In addition to the admin console that runs on port 9090, there are some other ports that Openfire uses to facilitate communication. These include port 5222, which the client uses to connect to Openfire, and port 7777, which is used for file transfers. All ports used by the server are listed on the main page of the web admin console.

If you're running an external database server you should use it instead of the database for greater performance. Create a database for Openfire in your database server and then populate it by using the appropriate database schema from under the Openfire installation (/usr/share/openfire/resources/database/). Openfire ships with database schemes for several databases, such as IBM's DB2, PostgreSQL, Microsoft's SQL Server, and more.

You'll also want to connect the Openfire server to a directory server such as OpenLDAP, if you've one running on your network. You need to know the hostname or IP address and the port of the machine the directory server is running on, its BaseDN, and the authentication information.

You should then re-run the Openfire setup wizard by editing the /etc/openfire/openfire.xml file and changing `<setup>false</setup>` to `<setup>true</setup>`. Now select the Directory Server button in the profile settings step and enter your server's details. Once Openfire connects, you can pick the elements used to populate the user's IM profile.

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2x VPN

Vigor2760 Series

- Built-in VDSL2 / ADSL2+ modem with USB 3G/4G Backup
- Selectable Gigabit WAN / LAN (for NBN / Cable Connection)
- 4 x Gigabit LAN ports with 30,000 NAT sessions
- 2 x VPN tunnels with hardware accelerator
- Advanced Wi-Fi for Vigor2760n and Vigor2760Vn
- SIP VoIP (2 x FXS and 1 x Line port) for Vigor2760Vn

TAIWAN EXCELLENCE 2013

32x VPN

Vigor2860 Series

- Built-in VDSL2 / ADSL2+ modem, 1 x Gigabit WAN port & 2 x USB ports for 3G/4G Mobile with Load Balance and Fail-Over
- 6 x Gigabit LAN ports with 50,000 NAT sessions
- 32 x VPN tunnels with VPN load balance and redundancy, Central VPN Management & 16 x SSL VPNs
- Advanced Wi-Fi for Vigor2860n
- Dual-Band Wi-Fi for Vigor2860n-Plus & Vigor2860Vn-Plus
- SIP VoIP (2 x FXS and 1 x Line port) for Vigor2860Vn-Plus

Broadband VPN Firewall Routers

2x VPN

Vigor2120 Series

- 1 x Gigabit WAN port with USB 3G/4G Backup
- 4 x Gigabit LAN ports with 30,000 NAT sessions
- 2 x VPN tunnels with hardware accelerator
- Dual-Band Wi-Fi for Vigor2120n-Plus

TAIWAN EXCELLENCE 2014

16x VPN

Vigor2912 Series

- 2 x Fast Ethernet WAN ports & 1 x USB ports for 3G/4G Mobile with Load Balance and Fail-Over
- 4 x Fast Ethernet LAN ports with 30,000 NAT sessions
- 16 x VPN tunnels with hardware accelerator & VPN Fail-Over
- Advanced Wi-Fi for Vigor2912n

TAIWAN EXCELLENCE 2013

50x VPN

Vigor2925 Series

- 2 x Gigabit WAN ports & 2 x USB ports for 3G/4G Mobile with Load Balance and Fail-Over
- 5 x Gigabit Ethernet LAN ports with 50,000 NAT sessions
- 50 x VPN tunnels with Central VPN Management & 25 x SSL VPNs
- Advanced Wi-Fi / Dual-Band Wi-Fi / VoIP

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Get familiar with OS X's new Photos app

Matthew JC. Powell offers a few tips on easing the transition from iPhoto.

When you update your Mac from OS X 10.10.2 to 10.10.3, something fairly substantial is going to happen, especially if you're an iPhoto user: you're no longer an iPhoto user. Apple's all-new photo-management application, entitled "Photos" and with an icon to match its iOS namesake, has taken over in a mandatory sort of way.

That's not an entirely bad thing – Photos has some real advantages over iPhoto – but more than a few Mac users are a touch peeved at the whole "not having a choice" aspect, and the fact that the new program looks so different and seems, at first blush, to be missing a lot of features.

FIRST, THE SIDEBAR

One of the most confronting aspects of the Photos interface is how very iOS-like it is – everything in one window, and the sidebar gone. If you're used to navigating around your albums and projects and different views in iPhoto using the sidebar (and who isn't) this can prompt a moment of mourning for the years of work you have apparently lost.

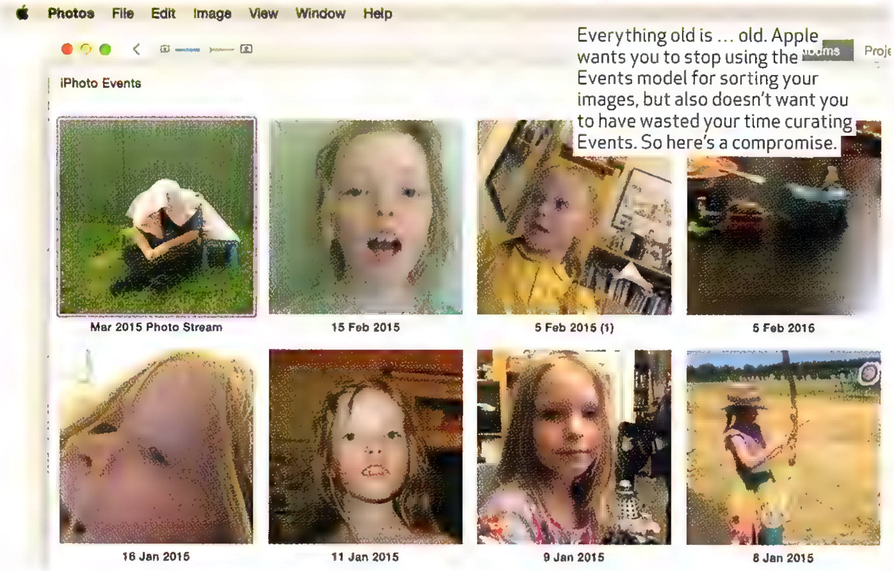
In fact, getting it back is as easy as going to the View menu and selecting 'Show Sidebar'. It's pretty much the same sidebar you used to have in iPhoto, so you'll be instantly reunited with all the projects and albums you so painstakingly created.

Of course, if you're one of the many iPhoto users who regarded the sidebar with its permanent reminders of every single album, book, et cetera you ever created constantly cluttering your view, you can send it away just as easily.

NEXT, THE TITLES

By default, Photos displays your pictures with no identifying information around them, unlike iPhoto which showed the file name or any title you had manually applied. Again, this information has not been discarded, it's merely not being displayed.

Under the view menu, click on Metadata, and from the submenu select Titles. Whether you had given your photos names or whether they were simply displayed with their file names, this information will magically appear in the viewing window.



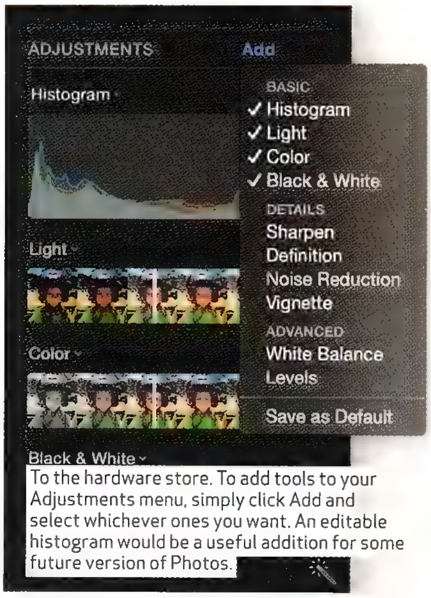
Everything old is … old. Apple wants you to stop using the Events model for sorting your images, but also doesn't want you to have wasted your time curating Events. So here's a compromise.

WHAT ABOUT MY EVENTS?

iPhoto originally sorted your photos into 'Rolls' – basically whatever was imported at the same time, that's a Roll – and then switched to 'Events' whereby photos taken at the same time were grouped together, even if they were imported separately. You also had the option to create your own Events by splitting off some photos and grouping others together.

Photos switches to grouping your shots by 'Moments' – broadly, this is photos taken at the same time and in the same place, regardless of when they were imported to Photos. (Now that most people are using their iPhones and syncing automatically, the moment when something was imported is less relevant.)

Again, if you've painstakingly created Events and sorted your photos over so many years, you may feel a sense of loss with this change. You may also find that most of the Moments that Photos has sorted for you are identical to the Events that you manually created – it's kind of clever that way. Of course if some of your photos were taken with cameras that lacked geotagging, that won't be the case. There are all sorts of reasons why Moments and Events might not match up.



To the hardware store. To add tools to your Adjustments menu, simply click Add and select whichever ones you want. An editable histogram would be a useful addition for some future version of Photos.

But fear not, your Events are not lost either. You just can't create new ones.

Across the top of the main Photos window are your four view options: Photos, Shared, Albums, Projects. Click on Albums.

At the top of the window will be the Albums Photos automatically creates, which are roughly analogous to the groupings iPhoto used to create. At the bottom will be 'My Albums' – Albums you created in iPhoto, plus a couple of extras. The first is one called 'Flagged'

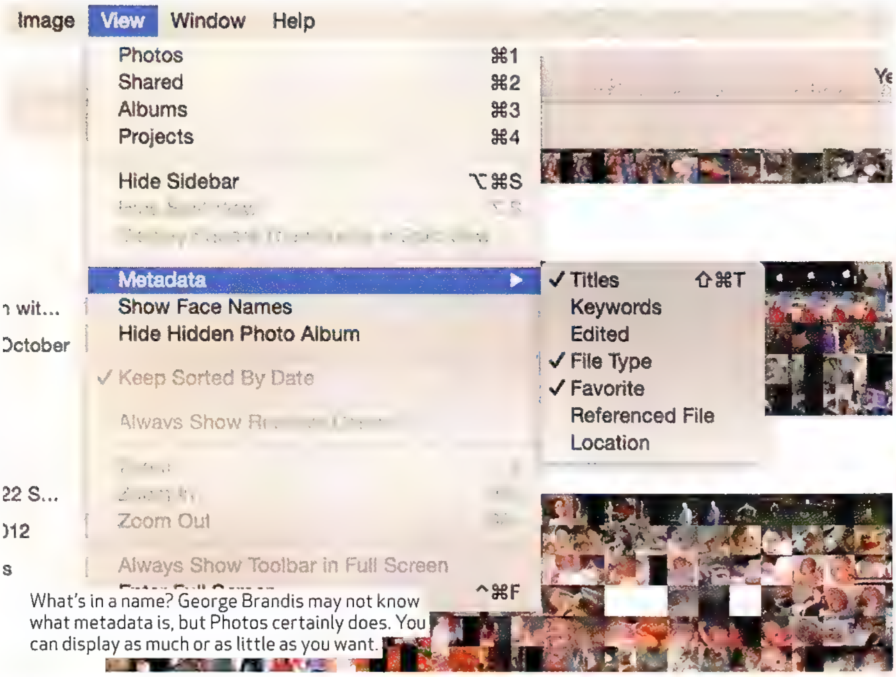
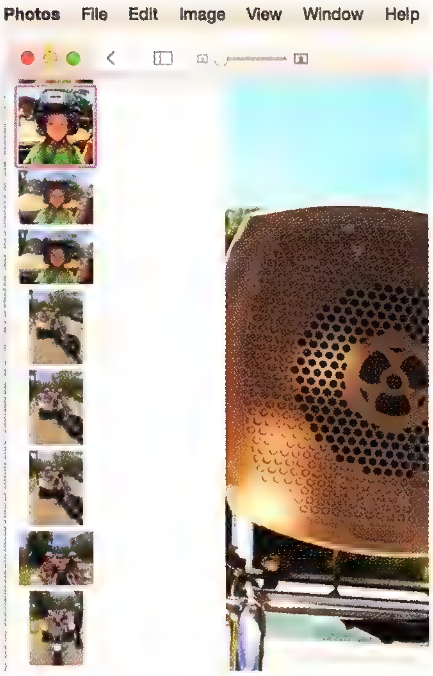
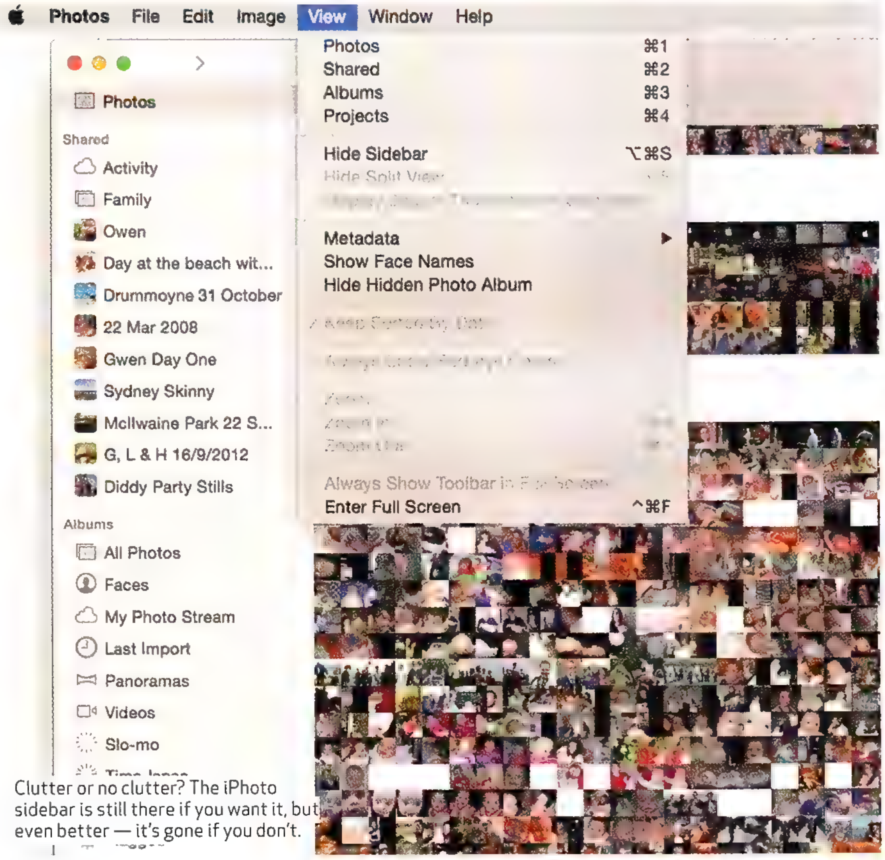


Image
View
Window
Help
Photos ⌘1
Shared ⌘2
Albums ⌘3
Projects ⌘4
Hide Sidebar ⌥⌘S
Metadata
Show Face Names
Hide Hidden Photo Album
✓ Keep Sorted By Date
Zoom Out
Always Show Toolbar in Full Screen
^⌘F
✓ Titles ⇧⌘T
Keywords
Edited
✓ File Type
✓ Favorite
Referenced File
Location

What's in a name? George Brandis may not know what metadata is, but Photos certainly does. You can display as much or as little as you want.


Photos
File
Edit
Image
View
Window
Help

All in a Moment. When you double-click an image, you can see the other photos in the same Moment by toggling the split-screen icon at the top of the window. If you want to see the photos uncropped, go to the View menu and toggle the "Display Square Thumbnails in Split View" option.


Photos
File
Edit
Image
View
Window
Help
Photos
Shared
Activity
Family
Owen
Day at the beach wit...
Drummoyne 31 October
22 Mar 2008
Gwen Day One
Sydney Skinny
McIlwaine Park 22 S...
G, L & H 16/9/2012
Diddy Party Stills
Albums
All Photos
Faces
My Photo Stream
Last Import
Panoramas
Videos
Slo-mo
Photos ⌘1
Shared ⌘2
Albums ⌘3
Projects ⌘4
Hide Sidebar ⌥⌘S
Hide Split View
Metadata
Show Face Names
Hide Hidden Photo Album
Always Show Toolbar in Full Screen
Enter Full Screen ^⌘F

Clutter or no clutter? The iPhoto sidebar is still there if you want it, but even better — it's gone if you don't.

which automatically groups together photos you've marked for whatever reason. The second – and the point of this little diversion – is called 'iPhoto Events'. Click on it and lo and behold, your old Events are right where you left them.

You'll notice, of course, that this album ends at the date you upgraded to 10.10.3 and Photos – Apple wants you to get used to working in Moments, not Events – but at least the time spent curating your old photos is not lost.

ABOUT EDITING...

OK, this is where things get a little awkward. Remember how in iPhoto you had the option to 'Edit in External Editor' which would allow you to open your photos in a more powerful image-editing application and save them straight back to iPhoto? Can't do it anymore. Apple clearly intends to switch to a more iOS-like workflow with Photos, whereby you can access various features of other applications which plug in to Photos. Right now there aren't any external applications that plug into Photos on OS X.

This would be OK if Photos had a more rounded set of editing tools. But on the face of it, it's a huge step backwards – there isn't even a histogram!

Ah, but there is. Double-click on an image you'd like to edit, then click the Edit button in the upper-right corner. Click on Adjust to open up the very limited default set of Adjustment tools.

You may notice the word 'Add' appears next to 'Adjustments'. Click on it, and a group of additional tools becomes available, including the familiar histogram (unfortunately it's an indicative histogram rather than an editable one – you can use it to see the effect that other tools have). Click on whichever tools you wish to add, and they appear in your toolbox. If you want that set of tools to be available every time, click on Add and select 'Save As Default'.

Hopefully that's enough to get you started on being less intimidated by the unfamiliarity of Photos. Hopefully, also, the functionality of the program will improve with future versions – right now it needs work. ■

Creating a quiet but beastly PC

Tom McNamara shows that low noise doesn't mean low joys.

Over the last few months, in the creaking depths of the secret *APC* lair, we've been constructing compact PCs or just putting shiny new things together and seeing what they do. And that's usually pretty entertaining. But it occurred to us that it's been a good while since we tackled a quiet PC build. After all, as much as we like raw power, we don't want to hear that power all day long.

But that doesn't mean we need to sacrifice performance. If we create a whispery rig, we can still build it to growl and roar in its own way. And it's not as difficult as you might think. With the right case, CPU cooler, and videocard, everything can fall into place. Luckily, the hardware components market is chock-full of interesting possibilities, one of which was so new that it hadn't even been reviewed as this issue went to press. We entered this undiscovered territory, and we think it was worth the journey. This build didn't turn out quite the way we expected, but a little ingenuity made it come together in the end.

> "It's been a good while since we tackled a quiet PC build."

ARMED TO THE TEETH

The most important element of a quiet PC build is the case. You want to keep the racket down, and that means sound-absorbing panels. You can glue your own in, or you can buy cases with panels pre-installed. Last time, we used a Fractal Design Define R4, which is still a fine choice. But we needed something with more airflow (the R4 comes with only two fans). Enter the NZXT H440. We decided to go a step further and get the Razer edition, which is almost all black, save for a few neon-green details. It has three 120mm intake fans, a 140mm exhaust fan, and space for a large radiator up top. It fit the bill. The radiator belongs to the Corsair Hydro H110i GT. This has a 280mm radiator, thick tubing, and some nice aesthetics.

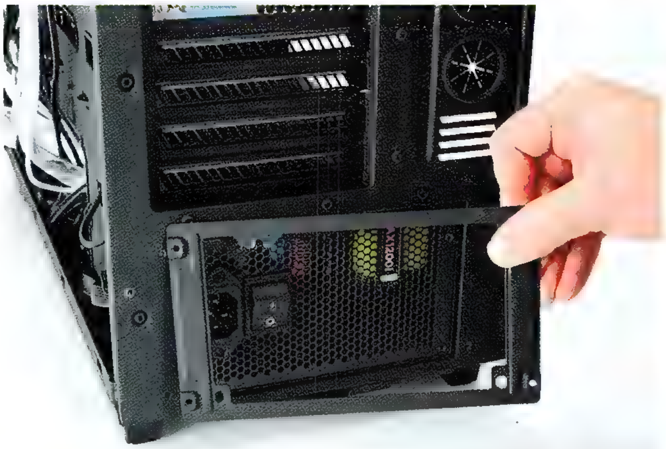
The H110i will be cooling an Intel Core i7-5960X. Like we said, we're not holding back. This 8-core, 16-thread chip is a monster for things like video editing and virtual machines, and we can overclock it quite a bit with the H110i. This hefty CPU sits on an ASUS X99 Pro motherboard, which is a premium, feature-packed job. Along for the ride is 32GB of Corsair Dominator DDR4, a 960GB OCZ Vector 180 SSD, a 6TB hard drive from HGST, an MSI R9 290X Lightning, and a Corsair AX1200i power supply. Ladies and gents, we do not mess around. Read on to see how this epic stack of gear comes together.

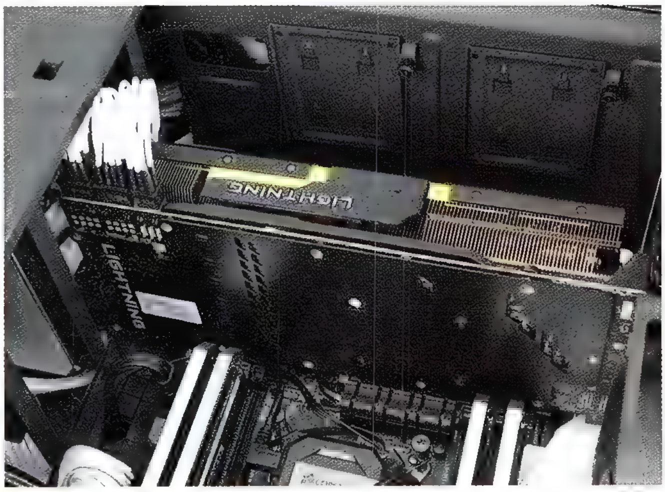
INGREDIENTS

PART		PRICE
CASE	NZXT H440 (RAZER EDITION)	$159
PSU	CORSAIR AX1200I 1,200W	$449
CABLES	OPTIONAL CORSAIR CABLE KIT (WHITE)	$119
MOBO	ASUS X99 PRO	$459
CPU	INTEL CORE I7-5960X	$1,499
GPU	MSI R9 290X LIGHTNING	$839
RAM	4X 8GB CORSAIR DOMINATOR DDR4	$1,200
HDD	6TB HGST ULTRASTAR HE6	$775
SSD	960GB OCZ VECTOR 180	$779
OS	WINDOWS 8.1 64-BIT OEM	$149
TOTAL		$6,427

how to

Time to put the parts together.





1 POWER BEHIND THE THRONE

The power supply finds its cosy new home in a separate chamber at the bottom of the case, and it gets in there by sliding in gently through the back of the case, instead of coming in from the side as it usually would. To make that happen, you have to first remove this plate, which is held down by four thumbscrews. Then you slide your PSU in, put the plate back on, and screw the plate into the PSU.

If you're using a modular power supply, like we are for this month's build, you also need to hang back and attach your cables before you get going with sliding the PSU in. That's because the back of the PSU will be difficult to reach past this point. It's a bit of pain, but that's always going to be one of the drawbacks of a clean-looking case.

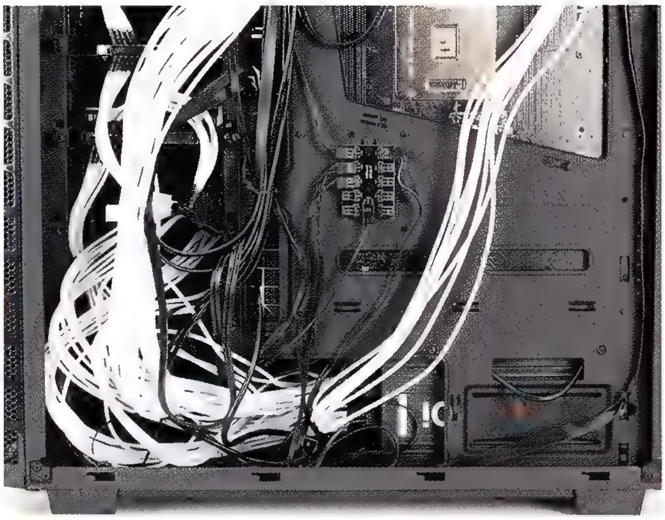
2 GOING TO GREAT LENGTHS

Interesting hurdles show up right away. We've put the mobo's I/O shield in, screwed the motherboard into the case, and installed our RAM sticks, when we notice the videocard is longer than expected. Thankfully, we can remove a drive tray in the front to make room.

It's attached with two thumbscrews and slides right out. But connecting the power cables is tight, even when you use these flexible ones. That's partly because this card is also taller than usual. If it used the reference height, then regular rounded cables would probably be fine. Also note this card uses an extra 6-pin cable. Our 8-pin cables come with two detachable pins, so we took the cable with the bonus pins and tucked it out of the way. There's a side window, so we want it looking tidy.

3 UNO, DOS, TRAYS

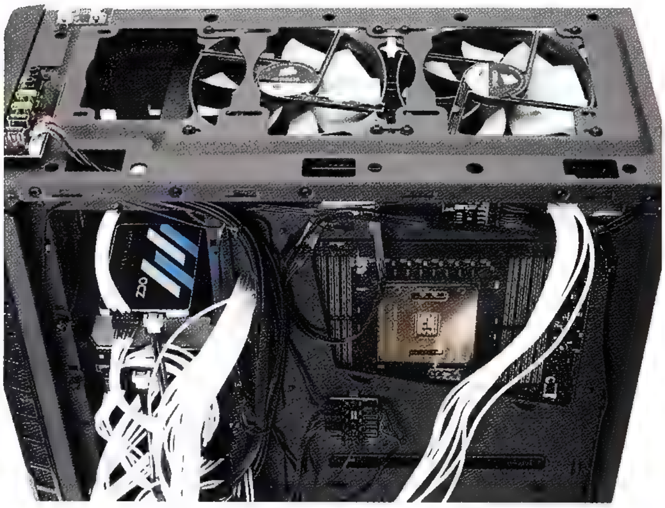
There are two trays on top of the power supply compartment where we could have put our solid-state drive, but we like hiding it out of the way. You may have noticed by now that the H440 has no 5.25-inch drive bays. This cage has only 3.5-inch trays, which can also take 2.5-inch drives. After making room for the videocard and the CPU cooler, we had three trays left. We took the two that were closest to each other and used them for the SSD and the HDD. That allowed us to use one SATA power cable (which also connected to the CPU cooler). The drive attaches with a set of small bundled screws.



4 SOMETHING UP OUR SLEEVE

Our fancy individually sleeved cables came in handy behind the motherboard, because there wasn't as much space back there as we would have liked. The sound-absorption panel takes up a few millimeters in an already-challenging space. Thankfully, there was plenty of room in front of the power supply to tuck things out of the way, and we'd removed two drive trays for some more space. Since the drive cage in the front of the case is hidden by a large metal plate, we were able to use that to our advantage and obscure most of the mess.

We also made sure to install the 8-pin CPU power cable before installing the CPU cooler. Otherwise, the cooler's radiator and fans would have blocked our path. We also needed to whip out a Molex cable to power the hub that the case fans were connecting to. The fans themselves were hooked up to the hub at the factory, so that saved us some time and energy.



5 JOINING THE FAN CLUB

The H440 case can take up to two 140mm fans on top, and up to three 120mm fans. But because of the contour of the frame, you can't set the radiator right against the metal. It's too tight. You have to put the fans in between the case and the radiator, which can be pretty tricky if you haven't tried it before. Getting the screws to line up correctly with the holes in the fans and the radiator is a time-consuming process.

We have the fans facing upward so that they will pull the heat rising off the radiator and send it out the vent in the panel that will sit on top of the case. The fans also need to be oriented so that their cables come out at the same location. This makes cable management much cleaner once the fans are hooked up to the cooler. You just tug the cables gently back behind the motherboard until you run out of slack.

6 TWO CAN PLAY THIS GAME

The H440 had room for pretty much everything we threw at it, but there wasn't space to add two more fans to the radiator. This is pretty normal for a mid-tower case. What we didn't expect is just how tight our fit would be. There's literally 1 to 2mm between the radiator and the mobo's rear I/O shroud. Because of this limitation, the radiator tubes had to be placed on the other end, and putting another set of fans on the cooler was out the window.

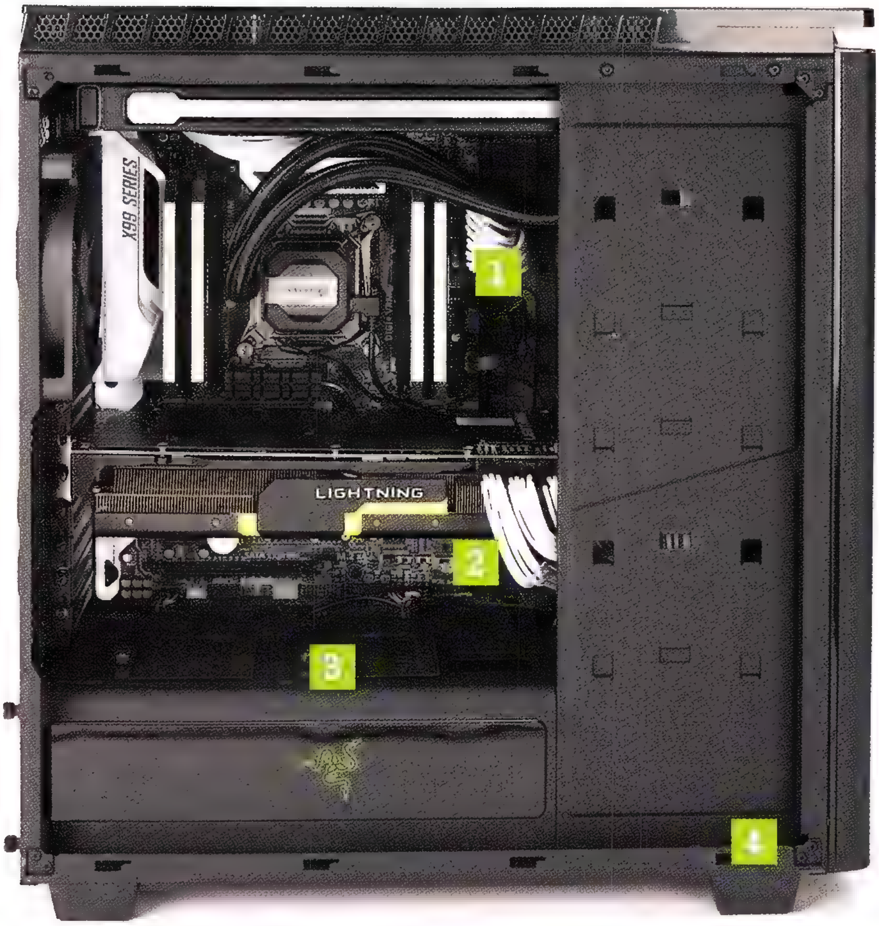
The side effect was that installing the CPU cooler with the Corsair logo right-side up was difficult to do in a way that looked natural. So we ended up with the logo upside-down. Not a big deal, and it has no impact on performance. We chalked it up to a learning experience. We've seen this case accommodate two extra radiator fans before — it's just not going to work with this particular motherboard.

1 The rubber grommet we're feeding the motherboard power cable through is at about a 30-degree angle, so your cable doesn't have to bend as much as usual.

2 For reference, this videocard is about 12 inches long and takes up three slots. It's a big mother. If you have a dual-slot card, there's still space to add a second one below.

3 This panel is a 2.5-inch drive tray held down by a thumbscrew. There are gaps behind it where cables can go in and out.

4 These feet elevate the case so that the power supply's intake fan gets enough clearance to do its thing. There's also a slide-out filter under here.



CONQUERING THE QUIET LIFE

As we're preparing this issue for the printers, OCZ informed us it was pushing back the release date of its Vector 180 SSD, due to unspecified technical problems brought to its attention by people it had sent these units to for review. It was too late for us to re-build, re-benchmark, and re-photograph, so you'll have to visualise your favourite SSD in there instead. The good news is that SSD selection has a negligible impact on our set of benchmarks.

Speaking of performance, we were impressed by how easily the ASUS X99 Pro overclocked this CPU. An OC from 3GHz to 4GHz at 1.3 volts is nothing to sneeze at, but this board needed no tweaking beyond our initial set of adjustments, which was mostly just beefing up the power sent through the voltage regulators. Not many programs use 16 CPU threads, which is why this chip wrecked our zero-point machine's stock-clocked hex-core i7-3930K in some tests, but not in others. The 5960X got into the low 80°C range during our Premiere Pro bench, indicating there wasn't much wiggle room left. You'd probably need a custom water cooling loop to push performance much further.

But let's not forget why we built this system to begin with: quietude. Well, plugging the fan hub directly into the power supply will create some noise, and there's no fan speed controller. And the CPU cooler's fans are also right underneath the top panel, instead of the radiator getting sandwiched in between. So the Fractal case we mentioned earlier still has some better options for noise level, and more space behind the mobo for cable routing.

Still, the case's stock fans aren't loud, and the sound-absorbing panels do muffle some noise, though the window on the side panel has an acoustic cost as well. If low noise is really important to you, we'd recommend the Define R4, though it needs at least one more fan for good airflow. The MSI Lightning card, with its monster three-fan, triple-slot cooler, hardly rose above a mild drone throughout testing, yet it still punched above its weight in *Batman: Arkham City*. The 290X is a great GPU that performs within range of an Nvidia GeForce GTX 980, but for less money.

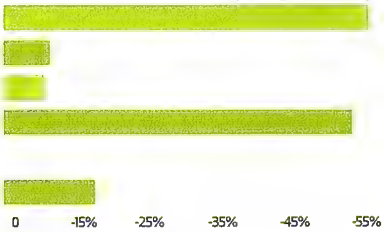
Overall, we enjoyed wrangling this build into shape, and we were gratified to get solid, stable overclocks without needing hours of experimenting and fine-tuning. ■

LABS BENCHMARK RESULTS

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K 3.8GHz, 8GB of Corsair DDR3/1600, on an ASUS Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Win7 Pro.

Performance compared

	APC TEST BED	OVERALL SCORE/CHANGE IN
PREMIER PRO CS6 (SEC)	2000	1263
STITCH EFX 2.0 (SEC)	831	753
PROSHOW PRODUCER 5.0 (SEC)	1446	1328
X264 HD 5.0 (FPS)	21.1	31.8
BATMAN ARKHAM CITY (FPS)	76	91 (+16.5%)
3DMARK 11 EXTREME	5847	5005



Intel, Google rev up mini-PC market

Chipzilla and the maker of Android jump on-board the mini PC bandwagon. **Darren Yates** looks at what could be a game-changer for the format.

It's no secret that we're fans of mini PCs, those tiny computer-in-a-stick devices powered by Android and running low-cost multi-core ARM processors for under $50. We've been writing about them since they first arrived in mid-2012 and while we've lamented the lack of big-name support for the concept, it looks as though that's all set to change soon.

INTEL COMPUTE STICK

Originally shown at the Consumer Electronics Show in Las Vegas earlier this year, the Compute Stick (**tinyurl.com/nrmx5n2**) was finally slated to go on sale May 1 this year in the US through online retailers such as Newegg and Amazon.

Powered by Intel's 1.33GHz quad-core Atom Z3735F CPU, the Compute Stick will now come in two versions, one preloaded with Windows 8.1; another, with Linux (likely to be Ubuntu 14.04). The Windows version features 2GB of RAM, 32GB of flash storage, while the Linux version is said to include 1GB of RAM and 8GB of flash. Both incorporate microSD card storage, 802.11b/g/n Wi-Fi, Bluetooth 4.0, USB host and OTG ports plus an HDMI male connector on the end.

Essentially, Compute Stick aims to turn any HDMI-ready TV or monitor into a desktop computer. So far, pricing appears to be around US$150 for the Windows version and US$110 for the Linux option. We've asked Intel Australia about a local release and while the company is expecting it to arrive in Australia, no firm date had been set at time of writing.

ASUS' new Chromebit, a mini PC with RK3288 CPU and Google Chrome OS.

HOW IT WORKS

Tablets are mostly battery and LCD panel, with the actual electronics running the show compressed down into a tiny circuit board. Remove that LCD panel and battery and Compute Stick is basically what's left, a compact circuit board inside a small 10-centimetre dongle.

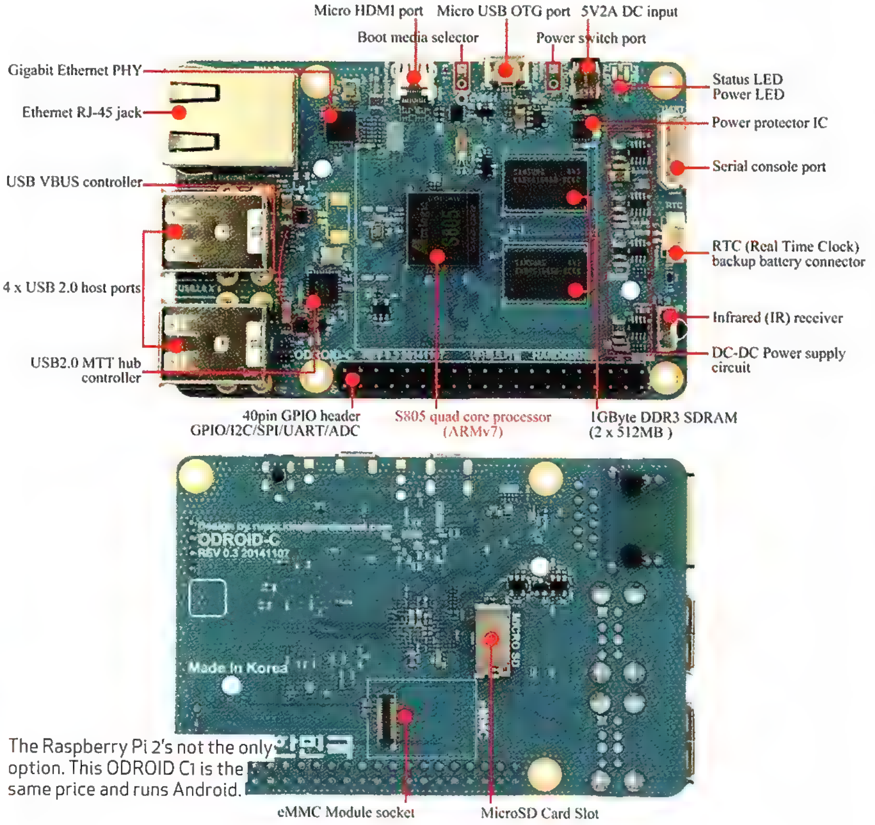
However, the US$150 cost may need a touch-up to compete, with some small-screen Windows tablets selling for not much more. For example, HP's Stream 8 and Acer's W1-810 Windows tablets have been selling for around the $170 mark recently in Australia, while Toshiba's Encore 2 has been available for as little as $159.

But if nothing else, it's quite remarkable that you can now carry a Windows PC in something not much larger than a USB flash drive.

HP's Stream 8 Windows tablet is priced similarly to the new Compute Stick.

ASUS CHROMEBIT

But Intel's not the only big-name brand jumping into the mini-PC market – notebook maker and netbook pioneer ASUS has joined forces with Google to release a Chrome OS-based mini PC called Chromebit (**tinyurl.com/lz6vkrj**). Expected to arrive during the winter quarter this year, Chromebit runs the new RK3288 quad-core Cortex A17 System-on-a-Chip (SoC) CPU from



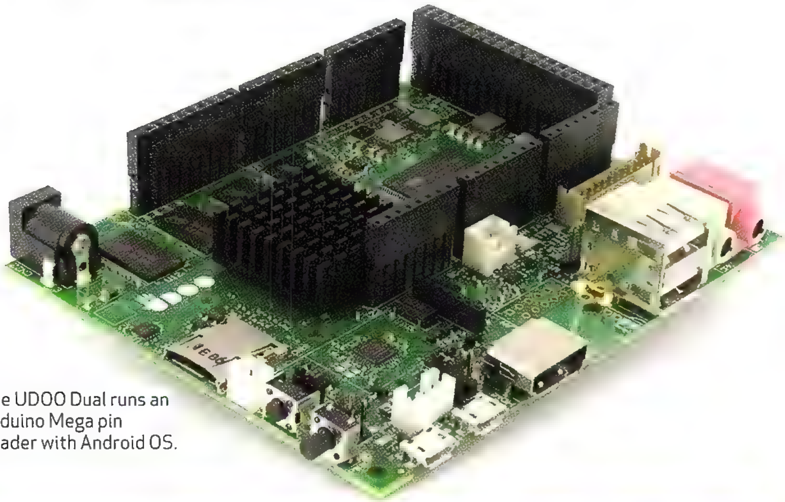
Micro HDMI port
Micro USB OTG port
5V2A DC input
Boot media selector
Power switch port
Gigabit Ethernet PHY
Ethernet RJ-45 jack
USB VBUS controller
4 x USB 2.0 host ports
USB2.0 MTT hub controller
Status LED
Power LED
Power protector IC
Serial console port
RTC (Real Time Clock) backup battery connector
Infrared (IR) receiver
DC-DC Power supply circuit
40pin GPIO header GPIO/I2C/SPI/UART/ADC
S805 quad core processor (ARMv7)
1GByte DDR3 SDRAM (2 x 512MB)
ODROID-C
REV 0.3 20141107
Made in Korea
eMMC Module socket
MicroSD Card Slot

The Raspberry Pi 2's not the only option. This ODROID C1 is the same price and runs Android.

Ugoos' $120 UM3 mini PC packs in 802.11ac Wi-Fi and 4K video support.

android
Rk3288 Suppport 4K/H.265
CS918 Plus

The CS918 Plus, a new console mini PC with quad-core CPU and KitKat OS.



The UDOO Dual runs an Arduino Mega pin header with Android OS.

> "While Android has so far been the OS of choice for the vast majority of mini PCs, Chrome OS is actually a more logical fit."

Chinese chipmaker Rockchip. It combines 2GB of RAM and 16GB of on-board flash with Bluetooth 4.0 and 802.11ac Wi-Fi.

Apart from featuring Google's Chrome OS, the other key addition is the swivel-head HDMI port, enabling the device to plug into almost any thing at any angle. Google itself is expecting the price to come in under the $100 mark.

While Android has so far been the OS of choice for the vast majority of mini PCs, Chrome OS is actually a more logical fit, being a desktop rather than mobile OS. And with Chrome OS now supporting Android apps natively, there's certainly no shortage of apps to play with.

CONNECTION OPTIONS

To make Compute Stick or Chromebit work as a compact desktop, you're still going to need much of the periphery you would for a budget Android stick – namely, display panel, powered USB hub, wireless access point, external mouse and keyboard. You should be able to get away with a Bluetooth or wireless keyboard/mouse combo through the USB host port on the stick itself, but other wired peripherals, particularly those needing bus-power such as portable hard drive storage, will require access to a powered hub.

THE FUTURE OF BUSINESS PCS?

With Intel marketing the Compute Stick to virtually everyone, it's worth noting the pitch to SMBs (small to medium businesses) for it as a thin-client device. As businesses look to pick up every dollar not nailed down, Compute Stick could provide a new wave of low-cost business PC solutions. One obvious benefit is the genuine 'plug and play' nature it could have with workers who move around the office regularly, since it wouldn't be much more complicated than plugging in a USB flash drive.

Data security is always going to be an issue for businesses and while Compute Stick might easily walk out the front door in your pocket, smartphones and tablets, increasingly seen as BYOD (bring your own device) options, are clearly no more secure in that regard.

ANDROID ALTERNATIVES

Of course, the Android mini-PC market hasn't stood still and there's been renewed development in the last six months, particularly with the arrival of Rockchip's new RK3288 SoC CPU. Rockchip is the Chinese maker of ARM CPUs that's been doing decent trade in budget tablets and phones over the last couple of years with big-name brands such as HP. It's also reportedly about to service Lenovo and ASUS with its older RK3188 quad-core Cortex A9 SoC CPU in up-coming low-cost Chromebooks. Rockchip competes with similar-tier CPU makers such as MediaTek and Allwinner in this crowded mobile/compact computing space.

The key with the RK3288 is its high-performance Cortex A17 cores clocking at 1.8GHz, combined with ARM's 600MHz quad-core Mali-T764 GPUs, the same GPU powering Samsung's original 20-nanometre Exynos 7 Octa CPU inside some Galaxy Note 4 phone/tablets. It should deliver a nice jump in all-round performance.

WHAT'S AVAILABLE?

When the first Android mini PCs arrived mid-2012, the transition to Android 4.0/Ice Cream Sandwich was on in earnest. Then for a while, things seemed to plateau on 4.2/Jelly Bean, but more recently, new models have arrived with 4.4/KitKat and, occasionally, 5.0/Lollipop support.

In terms of physical format, you'll find three different types of Android mini-PCs – the compact Compute Stick style, the TV set top box/console format and the bare-bones single-board computer (SBC) designs.

Each style has its benefits and drawbacks. The HDMI sticks are incredibly compact, but light-on for peripheral ports; SBCs are loaded with extras but fragile without some form of casing and the set-top box/console option provides the compromise 'middle ground'.

BUDGET TV STICKS

Right now, there's a myriad of models available, with older dual-core HDMI sticks and STB/console models powered by Android 4.2/Jelly Bean selling on eBay for under US$40, the cheapest option. The MK808B is the most popular budget offering, but be aware it can come with one of three different SoC CPUs – the original Jelly Bean/4.2 version with Rockchip's RK3066 chip, another with the slower RK3028A dual-core SoC and a new and more expensive quad-core option with Amlogic's S805 Cortex A5 chip and 4.4/KitKat OS.

It needs to be said that some HDMI stick mini PCs have had their issues, too – some users have complained about poor Wi-Fi reception, others about stuttering 1080p video playback.

Another common complaint from power-users has been the locking of screen resolution to 720p (1,280 x 720-pixels). However, modded community ROMs have become available for an increasing number of models to boost this to 1080p (1,920 x 1,080-pixels). The downside with doing this, though, is that this increases power consumption in older larger-scale SoC CPUs and generates more heat. Given these stick-style mini PCs have passive-cooling only in a tiny space, that's not generally ideal.

NEW RELEASES

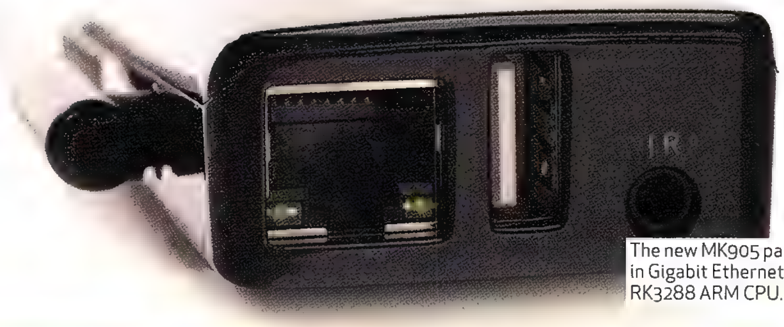
Today, there's a growing number of Rockchip RK3288 options available, starting from under US$80 online and powered by 4.4/KitKat. Many of these devices are advertised as '4K' models, thanks to the RK3288's ability to playback 4K-resolution video to suitable screens. You'll find these mostly as HDMI stick or STB/console options, occasionally with 802.11ac Wi-Fi, but also with 2.4GHz 802.11n. New HDMI stick options like the MK802-V5 and MK905 now even incorporate Gigabit Ethernet ports into the package for maximum network speed.

EXTENSION HDMI CABLES

The one thing we do recommend though is that if you do go for an HDMI stick, make sure it comes with a short HDMI extension cable. While you might be able to plug the device straight into your TV or monitor's HDMI port, this can end up putting considerable strain on the HDMI socket itself, depending on the angle. A short extension cable alleviates this and is definitely worthwhile.

QUAD-CORE
ANDROID 4.4
TFCARD
USB
HOST1
HOST2
SPDIF
HDMI
DC-5V

The Q8 STB mini PC, with RK3288 chip and KitKat/4.4 OS for around US$90.



The new MK905 packs in Gigabit Ethernet and RK3288 ARM CPU.

> "Everyone is churning out free-standing dev boards that not only act like normal computers, but also allow you to tinker and attach your own sensors and electronics."

ALTERNATE OS

With the horsepower now available, thanks to the RK3288 and new octo-core Allwinner A80 SoC CPUs, there's considerable effort going into porting Linux to more recent devices. For example, Ugoos UT3, UT3S and UM3 devices with RK3288 chips can now be flashed to run Ubuntu 14.04 Linux with the Xfce desktop environment. Ubuntu has a full repository of ARMv7-coded software so you won't be short of apps to run.

For devices without a specific Linux effort, there are generic RK3288 Linux images available, although it's likely external features such as Wi-Fi may not work, depending on the Wi-Fi chip used.

The good thing about running Linux on a mini PC, however, is that in most cases, it can be done by simply installing the Linux image onto a MicroSD card using a special image-writing app, loading the card into the mini PC and booting. To get back into Android, you just remove the flash card and reboot.

DEVELOPMENT BOARDS

When you pull one of these mini PCs apart, you can see that it's not that much of a jump to go from mini PC to 'Internet of Things' (IoT) and really, the IoT market is manic at the moment. Almost everyone is churning out free-standing development boards that not only act like normal computers, but also allow you to tinker and attach your own sensors and electronics.

There are dozens of these on the market now, even from the likes of Intel (Galileo and Edison) and AMD (Gizmo and Gizmo 2), but if you're interested in Android options, there are still plenty to choose from.

Wandboard (**www.wandboard.org**) is a recent release, based on the Freescale i.MX6 SoC series and available in single, dual and quad-core options. They recently received a Lollipop/5.0 source code release, courtesy of Google's Android Open Source Project (AOSP).

Board maker UDOO is about to launch a Kickstarter campaign for its

MINI TV for android
Dual-Core A9 Processor

The MK808B is hugely popular, but comes with a choice of three CPUs.

Rikomagic's MK802 V5, another mini PC with built-in Gigabit Ethernet port.

intel inside

The Intel Compute Stick should wake the market to the benefits of mini PCs.

new UDOO Neo (**www.udoo.org/udoo-neo/?lang=en**), aimed at the booming IoT market. This unusual board will feature the i.MX6 Solo single-core Cortex A9 SoC, but also include three-axis accelerometer, magnetometer and digital gyroscope, not to mention 802.11b/g/n Wi-Fi, Bluetooth 4.0 Low-Energy (BLE) and a heap of other wizzbangs. It'll even support the standard Arduino shield pin headers and like all good boards, it'll run either Android or Linux.

In the meantime, UDOO's current Dual and Quad boards feature Arduino Mega header pinouts and run 4.4.2/KitKat or Ubuntu 12.04 LTS operating systems.

ODROID-C1

The first-gen Raspberry Pi SBC appeared at about the same time as the first Android mini PCs arrived on the market, but since then, attempts to port Android to the mega-popular board have stalled. And with the new Raspberry Pi 2 available, it looks like there's no interest in an Android port, which is a pity given its ultra-low US$35 price tag.

But there is an alternative that could actually be even better than the Pi 2 (yes, I know – I speak sacrilege fluently). We've mentioned a few times the Korean dev board maker HardKernel, who've churned out some excellent low-cost boards using the Galaxy S3-powering Samsung Exynos 4412 quad-core SoC. Well, now, they've released the ODROID-C1 (**tinyurl.com/nazuv5v**), a very Pi-looking board, but with major differences. The C1 is powered by Amlogic's S805 quad-core Cortex A5 SoC running at 1.5GHz, but overclockable to 1.7GHz. The chip also has ARM Mali-450MP2 GPU support and runs 1GB of DDR3 RAM.

There's on-board Gigabit Ethernet (the Pi 2 only has 10/100 Ethernet) and a GPIO (general-purpose input-output) bus to add in your own extra components.

The Wandboard, one of a number supporting Linux and Android OSs.

Importantly, and something I think the Raspberry Pi has always lacked, the C1 includes a two-channel 10-bit analog-to-digital converter (ADC), similar to that found in Arduino's ATMEGA328P microcontroller chip. ADCs allow you to read analog signals into a digital environment and perform mathematical calculations (such as fast Fourier transforms) on them for doing all sorts of tricky stuff. They're extremely useful to have on-board if you're up for some serious development-type stuff.

Best of all, the C1 can run Ubuntu 14.04 or Android 4.4/KitKat – not bad for US$35 plus shipping.

THE CHOICE IS YOURS

Mini PCs are often the forgotten cousins in the Android family, but with the likes of Intel and Google now getting into the market (albeit with other operating systems), it's well time to take another look at these devices that combine all the best bits of Arduino, tablets and even Chromecast into a single compact device. And often at prices that border on silly-cheap. You may just never look at a desktop PC the same way again.

Arduino all-sorts

The Arduino Uno board is universally popular, but it's far from the only option. Darren Yates looks at some of the many alternatives.

For our Arduino Basics series (and the vast bulk of our Arduino Masterclass before that), we've used the ever-present Arduino Uno as the base for our projects. But it's time to introduce you to other members of the Arduino family, including some of the extended relatives.

The Arduino Uno's iconic shield pinheader makes it extremely easy to plug in expansion boards or 'shields', but it's only one way to launch into the Internet of Things (IoT) universe.

ARDUINO SIBLINGS

ARDUINO MEGA 2560

The Arduino Uno on steroids, the Mega has the same 16MHz/8-bit architecture but provides more digital I/O ports than you can shake an army of robots at. For the record, it's built around the Atmel ATMEGA2560 microcontroller, packing in 8KB of RAM and 256KB of program flash (compared with 2KB/32KB, respectively for the Uno). The Mega also powers a million open-source 3D printers, thanks to the RAMPS (RepRap Arduino Mega Pololu Shield).

ARDUINO NANO V3.0

At the other end of the scale is the Arduino Nano v3.0. If the Mega is a V8 Commodore, the Nano is a Mini Cooper S. In fact, it uses the same chip as the Uno (the ATMEGA328P), but in a much smaller package. The Nano is perfect for designing your own tech as it slots straight into reusable plug-and-play circuit boards called 'breadboards'. Being so small, it's also ideal for turning into wearable tech – and costs less than US$3 on eBay.

ARDUINO LEONARDO

The Leonardo is the next-generation of Uno, using the newer Atmel ATMEGA32u4 controller chip. The key difference here is that this chip features a built-in USB port, rather than outsourcing it to another chip like the Uno – that makes it perfect for designing your own USB peripherals. It can also simulate HID-grade peripheral devices, but users do mistake it for a Uno, which it's not. The drawback is that if you reset the board while USB-connected, you lose the USB connection and it must be re-established (which doesn't happen with the Uno).

ARDUINO PRO MICRO

This is to the Leonardo what the Nano is to the Uno – powered by the same ATMEGA32u4 controller chip, this isn't an official Arduino board and is actually a mash-up of the Leonardo, Nano and Pro Mini boards. However, instead of a miniUSB port connection, the Pro Micro uses the microUSB connector and is one of the smallest microcontroller boards you can I/O-connect via USB (not just use it for power).

FREETRONICS LEOSTICK

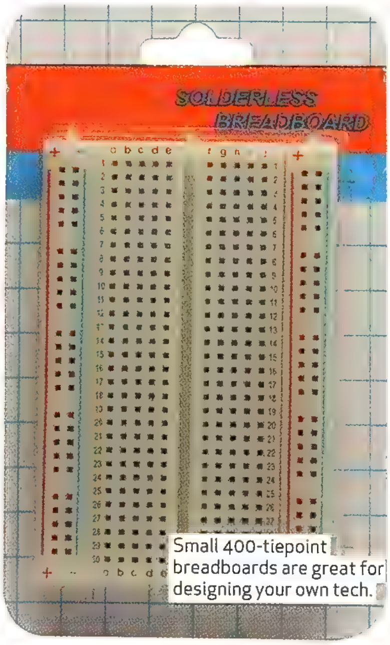
This is another trimmed-down Leonardo board, this time designed and made by local Australian brand Freetronics. The difference is it has its own built-in USB connector – you program it via the standard Arduino IDE, but you plug the board straight into any USB port. It also has a tiny piezo speaker. It's available in Australia for $26 from **freetronics.com.au** or pick one up from Jaycar Electronics.

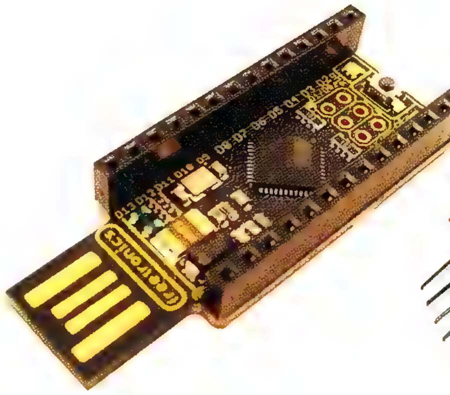
ARDUINO DUE

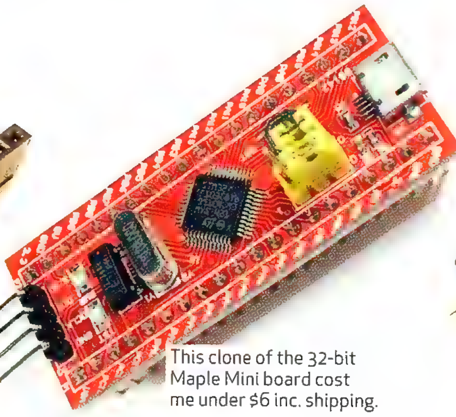
The Due was the first Arduino to feature a true 32-bit microcontroller in Atmel's AT91SAM3X8E. Clocking in at 84MHz, it has the same form factor as the Arduino Mega 2560, but with one key difference – it runs on 3.3-volts, not the traditional 5-volts of the previous boards. That means while it far better matches current-generation electronics design, you have to treat it carefully – plug 5-volts into its I/O ports and you'll likely just blow them up. It also won't run most made-for-Uno shields.

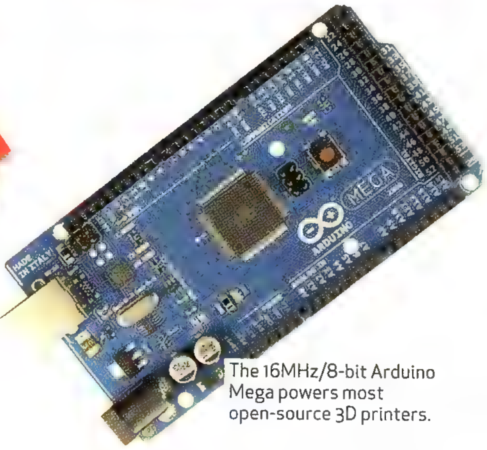
ARDUINO ZERO

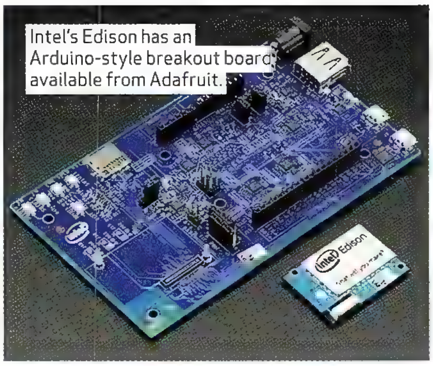
However, all eyes are on the soon-coming Arduino Zero. A genuine

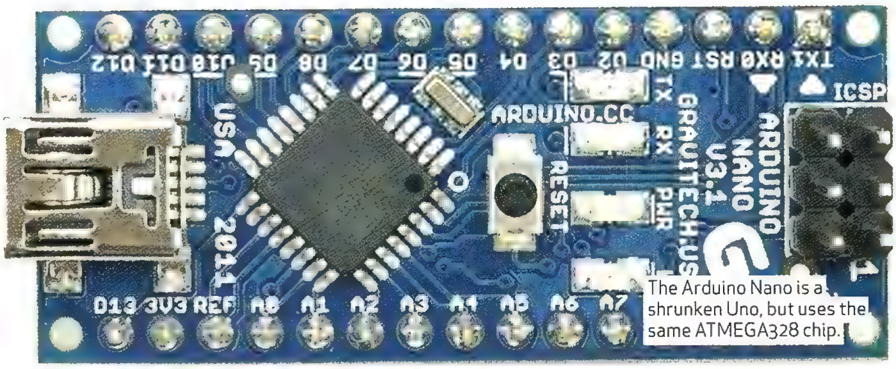

Small 400-tiepoint breadboards are great for designing your own tech.




This clone of the 32-bit Maple Mini board cost me under $6 inc. shipping.


The 16MHz/8-bit Arduino Mega powers most open-source 3D printers.


Intel's Edison has an Arduino-style breakout board available from Adafruit.


The Arduino Nano is a shrunken Uno, but uses the same ATMEGA328 chip.

replacement for the Arduino Uno, the Zero has the same form factor, but a new 32-bit ARM Cortex M0+ controller, called the Atmel ATSAMD21G18. Packing in 32KB of RAM and 256KB of flash, it has a raft of other advanced features including built-in DAC, a second programmable microUSB port, plus 10-pin JTAG port for hardware monitoring.

ARDUINO ALTERNATIVES

But the Internet of Things universe doesn't begin and end with Arduino – not by a long shot.

MAPLE MINI

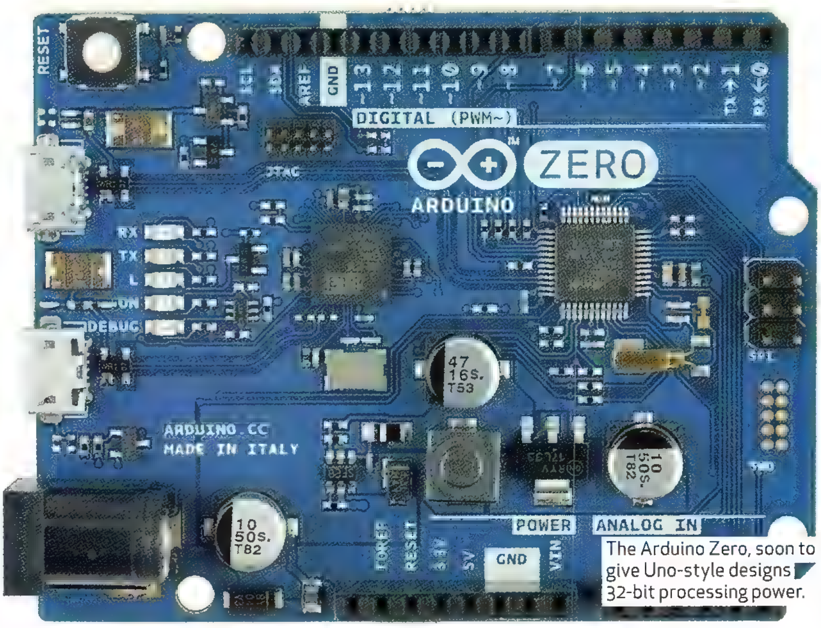
Long before Arduino found 32-bit religion, a small dev team called LeafLabs rattled off a 32-bit version of the Uno called the Maple. Based on a powerful ARM Cortex M3 controller, the team also built it into the smaller Maple Mini, a Nano-style board but with 32-bit horsepower. However by April this year, LeafLabs closed down its Maple works and Maple Mini knock-offs had begun appearing on eBay for under US$5. Community work goes on today to add these clone boards to the standard Arduino IDE.

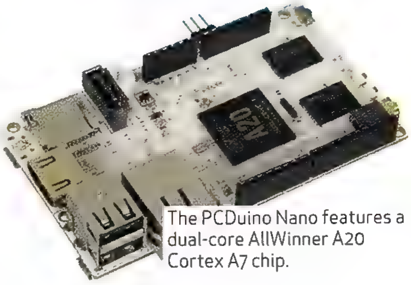
PCDUINO NANO

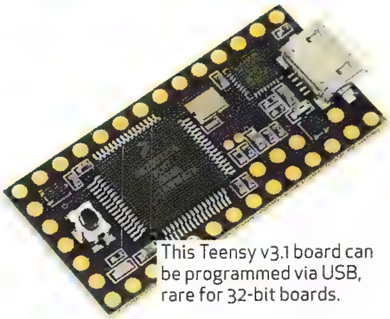
The Raspberry Pi brought DIY computing hardware to the masses, but the Pi's single-core 700MHz CPU overstayed its welcome and a number of alternatives began to hit the market. The PCDuino Nano is one example, combining Arduino-style I/O with 32-bit processing, even running Ubuntu Linux. It's available in Australia through Jaycar Electronics for $90 and packs in Allwinner's A20 dual-core Cortex A7 SoC CPU plus the Arduino Uno shield header. Like the Pi, this one has HDMI video output, USB2.0 ports, but also includes Gigabit Ethernet, even a SATA2 drive port. Nice.

INTEL EDISON

Even Intel has noticed the booming DIY/maker market and has released the new Intel Edison platform. This tiny board is powered by a 500MHz dual-core Atom SoC that also incorporates a 100MHz Quark microcontroller, along with 1GB of RAM and 4GB of on-board flash storage. You also get dual-band Wi-Fi and Bluetooth 4.0. The Edison can be mated to an Arduino-style breakout board to build your own gear in the Arduino style. You'll find a starter kit online for around US$110 from **adafruit.com** and **sparkfun.com**.


The Arduino Zero, soon to give Uno-style designs 32-bit processing power.


The PCDuino Nano features a dual-core AllWinner A20 Cortex A7 chip.


This Teensy v3.1 board can be programmed via USB, rare for 32-bit boards.

TEENSY V3.1

The new Teensy v3.1 is one of a number of similar boards that are stunningly tiny and ideal for fast wearable-tech dev work. It features a new powerful 72MHz ARM Cortex M4 controller with 64KB of RAM, 256KB of flash-storage and the whole thing is barely larger than an SD card. Best of all, you can program it through its on-board microUSB port (no external programmer hardware required, rare for 32-bit boards). Actually, the better thing still is its only US$20 online.

We don't have space to include the dozens of other options available from the likes of BeagleBoard, Parallax, Adafruit and more. But hopefully, this is an eye-opener to a much bigger world. Arduino is a great place to start – and we'll be sticking with it for the time being – but it's by no means the last stop in making your own tech.

If you want to join the IoT revolution, it doesn't cost a bomb to get started – and there are so many different options to keep you entertained for years. ■

ONE-STOP-SHOP FOR ARDUINO

Jaycar Electronics
Better. More Technical

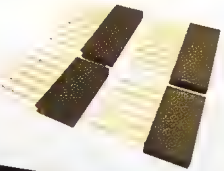
ARDUINO EXPERIMENTER'S KIT
XC-4262 $89.95
Everything you need to get started with the exciting new world of Arduino. Kit includes "Eleven" Arduino compatible board, servo motor, lights, buttons, switches, sound, sensors, breadboard and more. Complete with instructions, supporting web page and software examples. No soldering required.

PROTOTYPING BOARDS
FROM $12.95
Ideal construction base for Arduino and electronic projects. With clearly labelled rows and columns and adhesive back for mounting.

300 Terminal Holes PB-8832 $12.95
640 Terminal Holes PB-8814 $19.95

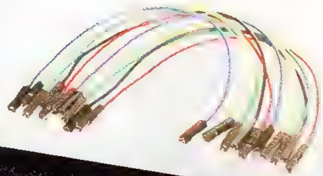
PB-8814

ARDUINO HEADER SET
HM-3207 $3.50
The perfect accessory to the ProtoShields and vero type boards when connecting to your Arduino compatible project. Includes 2 x 8 pins and 2 x 6 pins.



JUMPER LEADS SET
$3.95 EACH
Mixed jumper leads for use in Arduino projects. Sold in packs of 10 leads, each lead is 155mm long.

Plug to Socket/Socket to Socket WC-6021
Plug to Plug WC-6022



MINI GLUE GUN
TH-1997 $12.95
Fast and simple to use with trigger controlled glue feed. Ideal to hot glue the Arduino to the bottom of the box. Mains powered and requires 7mm diameter glue sticks (2 supplied).

Spare 7mm Glue Sticks

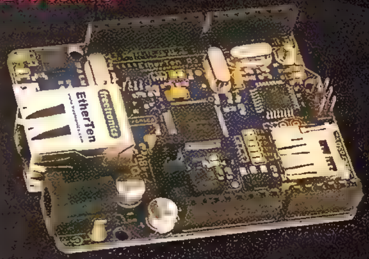
Pack of 6
TH-1991 $3.95

Pack of 50
TH-1994 $9.95

BUILD YOUR OWN ARDUINO PARKING SENSOR

If you have a garage which is barely long enough to fit your gigantic vehicles,
Build a reverse sensor with visual cue for parking to reduce any bumper imprints in the garage.

ETHERTEN BOARD
XC-4216 $69.95



Combine an Arduino and an Ethernet shield onto one single board - includes onboard Ethernet, a USB-serial converter, and even Power-over-Ethernet support. Also features a microSD card slot for storing gigabytes of web server content or data.

- ATmega328P microcontroller
- Built-in 10/100base-T Ethernet

Also available:
2GB Class 10 microSD Card XC-4998 $8.95

PIEZO BUZZER
AB-3462 $3.95

This mini unit offers medium to loud sound output, low current consumption and is extremely durable. Supplied with flying leads.

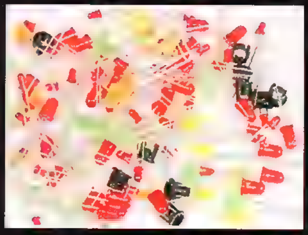
- Operating voltage: 3 - 16VDC
- Max sound output: 90dB

POE MIDSPAN INJECTOR
XC-4254 $26.95

Power up to four EtherTen's (XC-4216) with DC from a low cost plugpack across your home or office network cables. It isolates and powers the correct wires automatically.

- 4 channels of input/output jacks

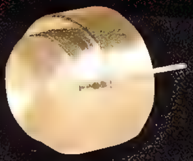
BARGAIN COMPONENTS PACKS
FROM $16.95
Value for money packs of assorted components. See website for full contents.



Resistors 300-Pieces
(10Ω to 1MΩ) RR-0680 $16.95

LEDs 100-Pieces
(3mm/5mm) ZD-1694 $29.95

ULTRASONIC TRANSDUCER
AU-5550 $6.95



2-in-1 transmitter/ receiver unit. Low power consumption with high sensitivity, reliability and stability. See online for full specs.

SERIAL-PARALLEL IC
ZC-4895 $3.35

Used in many Ardunio projects, this handy 8-bit 74HC595 IC allows you to use 3 valuable lines on your microcontroller for 8 outputs.

- Also functions as a shift register
- 16-pin serial- in/par-out latch

Head to our NEW website or scan QR code for your nearest store...

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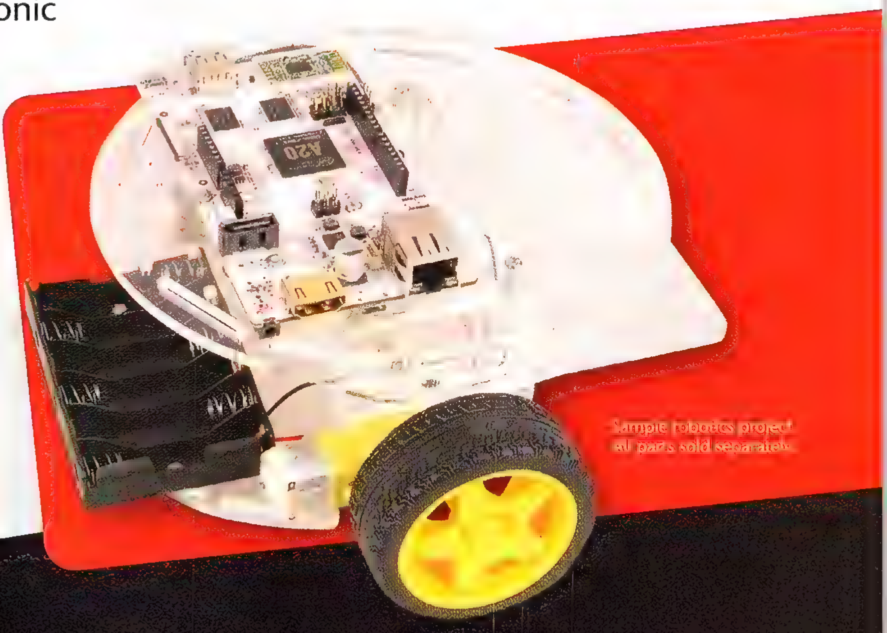
INTRODUCING pcDuino

MINI PC

pcDuino is essentially a full-scale personal computer on a compact board with lots of inputs and outputs, so you can create robotics projects, electronic controls or even a home theatre system.

- ✓ Blindingly fast
- ✓ Hugely powerful
- ✓ Highly cost effective

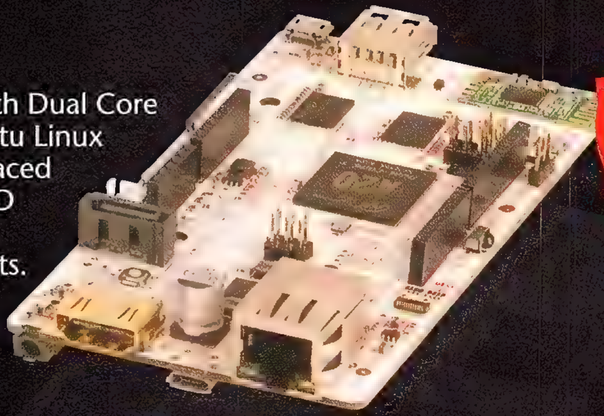
Also compatible with our wide range of Arduino shields, pcDuino provides you a level of flexibility rarely seen with board level personal computers on the market. See our helpful staff at your local store or visit our website to learn more.



Sample robotics project. All parts sold separately.

pcDuino V3.0

A high performance single board mini PC with Dual Core A20 processor. Comes pre-loaded with Ubuntu Linux and XBMC Media Centre, which can be replaced by Android OS if you prefer. Features microSD socket, 14 digital I/O, six analog inputs, two PWM outputs, SATA, Ethernet and HDMI ports. Also available in nano version without Wi-Fi or LCD connector (LVDS) for compact applications.



FROM $89.95

	XC-4352 **PCDUINO V3.0 NANO**	XC-4350 **PCDUINO V3.0 WITH WI-FI**
SoC	All Winner A20	All Winner A20
CPU	1GHz, ARM Cortex A7 Dual Core	1GHz, ARM Cortex A7 Dual Core
GPU	OpenGL ES2.0, OpenVG 1.1, Mali 400 core	OpenGL ES2.0, OpenVG 1.1, Mali 400 core
SDRAM	1GB	1GB
Flash Memory	4GB Flash	4GB Flash
Memory Expansion	microSD up to 32GB	microSD up to 32GB
Video Connection	HDMI 1.4	HDMI 1.4, **LVDS**
Audio Output	3.5mm Analogue	3.5mm Analogue, **I2S Stereo Digital**
Onboard OS	Ubuntu 12.04	Ubuntu 12.04
Supported OS	Android 4.2 (ICS) / Linux 3.0	Android 4.2 (ICS) / Linux 3.0
Extension Interface	Arduino	Arduino
Network Interface	10M/100Mbps/1Gbps	10M/100Mbps/1Gbps, **Built-in Wi-Fi**
USB Ports	2 x USB 2.0 & 1 x USB OTG	1 x USB 2.0 & 1 x USB OTG
SATA	SATA Host Socket	SATA Host Socket
Power	5V, 2000mA	5V, 2000mA
Size	96 x 60mm	121 x 65mm
RRP	**$89.95**	**$119.00**

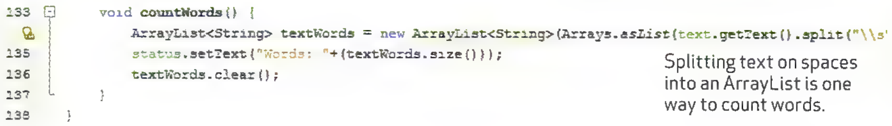
Included with the pcDuino, Scratch is a tile-based visual programming toolkit for pcDuino projects. It lets you create games, animated stories, interactive art, and share with others on the web.

*Monitor for illustration only.

www.jaycar.com.au | twitter.com/jaycarAU | Prices and offers valid to 24/06/15

Part 9 — reading and writing files

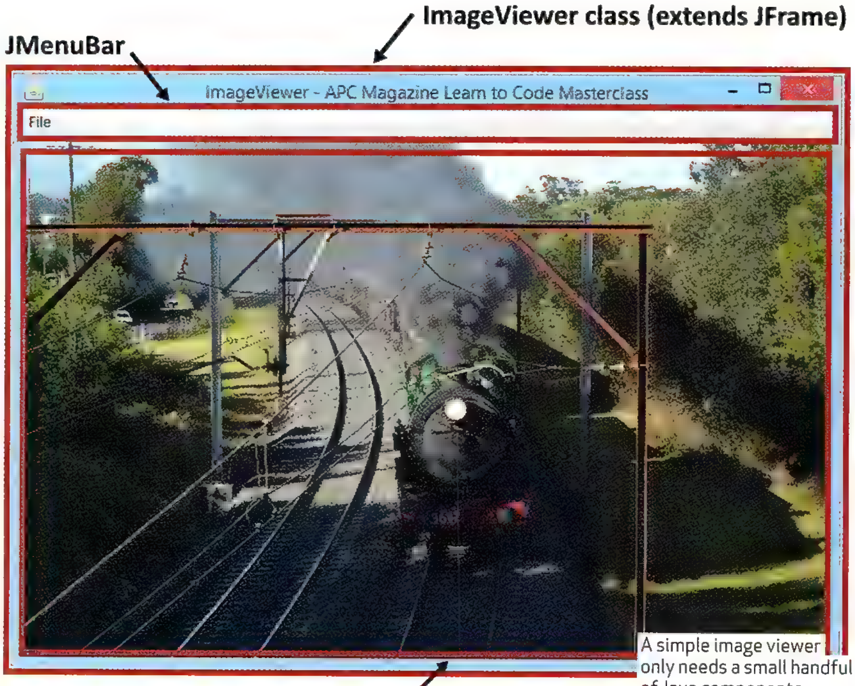
Learn how to load and save files in Java. **Darren Yates** shows how with new simple text editor and image viewer project apps.



```
    void countWords() {
        ArrayList<String> textWords = new ArrayList<String>(Arrays.asList(text.getText().split("\\s'
        status.setText("Words: "+(textWords.size()));
        textWords.clear();
    }
}
```

Splitting text on spaces into an ArrayList is one way to count words.

Java class components in ImageViewer app


ImageViewer class (extends JFrame)
JMenuBar
ImageViewer - APC Magazine Learn to Code Masterclass
File
ImagePanel class (extends JPanel)

A simple image viewer only needs a small handful of Java components.

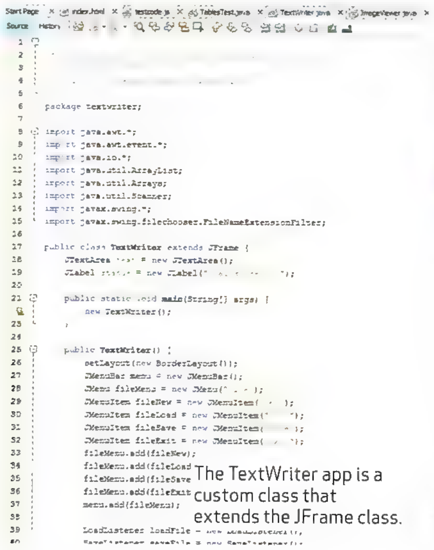
So far in our 'Learn to code Java' series, we've delved into the basics of programming through simple console apps and even begun exploring how to create applications with a graphical user interface (GUI). However, one thing all of the apps we've coded to-date have in common is that none of them store anything permanently – as soon as you shut down the app, any data you generate is lost.

This month, we're fixing that by looking at how to read and write files in your Java apps – first, by coding a simple text editor we've called TextWriter; and second, by building a basic image viewer. You'll find the source code for this month's projects on our website at **apcmag.com/magstuff**.

APP #1 - TEXTWRITER

Creating a text editor in Java is relatively easy, mainly because Java codes the toughest parts of the app for you. A couple of months ago, we introduced the JTextArea class, which is Java's built-in graphical user interface (GUI) multi-line text component. It does all the 'heavy lifting' in terms of accepting text entry, even to the point of supporting copy-cut-and-paste automatically. A few extra lines of code will add in extras such as automatic scrollbars and full word-wrapping. We've even added in a very simple word-count system that updates as you type.

But without the ability to load or save files, a text editor is just about pointless.



```
package textwriter;

import java.awt.*;
import java.awt.event.*;
import java.io.*;
import java.util.ArrayList;
import java.util.Arrays;
import java.util.Scanner;
import javax.swing.*;
import javax.swing.filechooser.FileNameExtensionFilter;

public class TextWriter extends JFrame {
    JTextArea text = new JTextArea();
    JLabel status = new JLabel("[illegible]");

    public static void main(String[] args) {
        new TextWriter();
    }

    public TextWriter() {
        setLayout(new BorderLayout());
        JMenuBar menu = new JMenuBar();
        JMenu fileMenu = new JMenu("[illegible]");
        JMenuItem fileNew = new JMenuItem("[illegible]");
        JMenuItem fileLoad = new JMenuItem("[illegible]");
        JMenuItem fileSave = new JMenuItem("[illegible]");
        JMenuItem fileExit = new JMenuItem("[illegible]");
        fileMenu.add(fileNew);
        fileMenu.add(fileLoad
        fileMenu.add(fileSave
        fileMenu.add(fileExit
        menu.add(fileMenu);

        LoadListener loadFile = new LoadListener();
```

The TextWriter app is a custom class that extends the JFrame class.

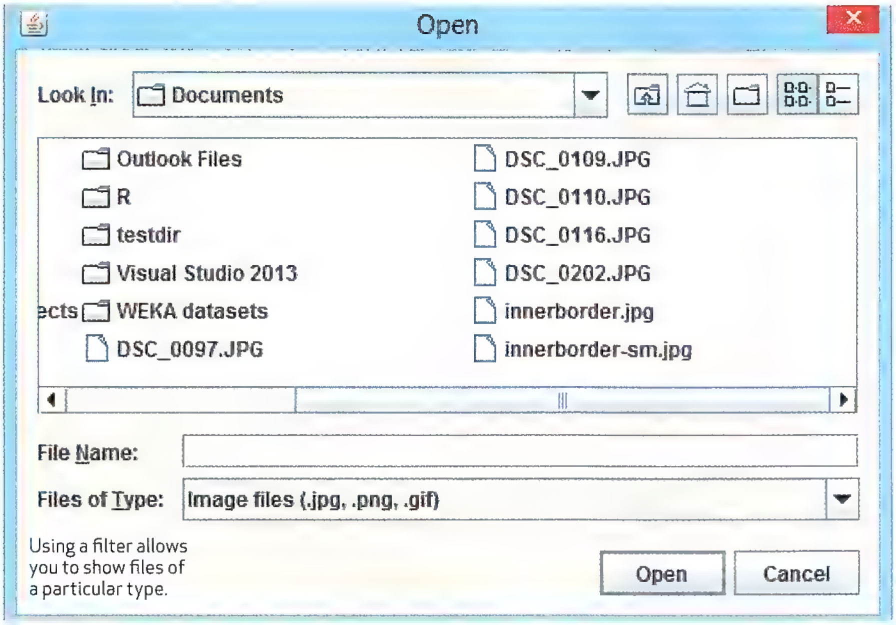
LAYOUT BASICS

The design of our app is extremely simple. We create a JFrame with a BorderLayout layout manager. The JTextArea object we've called 'text' is set to BorderLayout.CENTER and we've added a basic status bar (a simple JLabel) to BorderLayout.SOUTH. Remember that the way BorderLayout works is that anything designated 'CENTER' fills the majority area of the frame while the compass points (north, south, east and west) just use the minimum frame area needed for the particular object mapped to those locations. This means our status bar at the bottom of the frame will be only the height needed for one text line.

APPLICATION MENUS

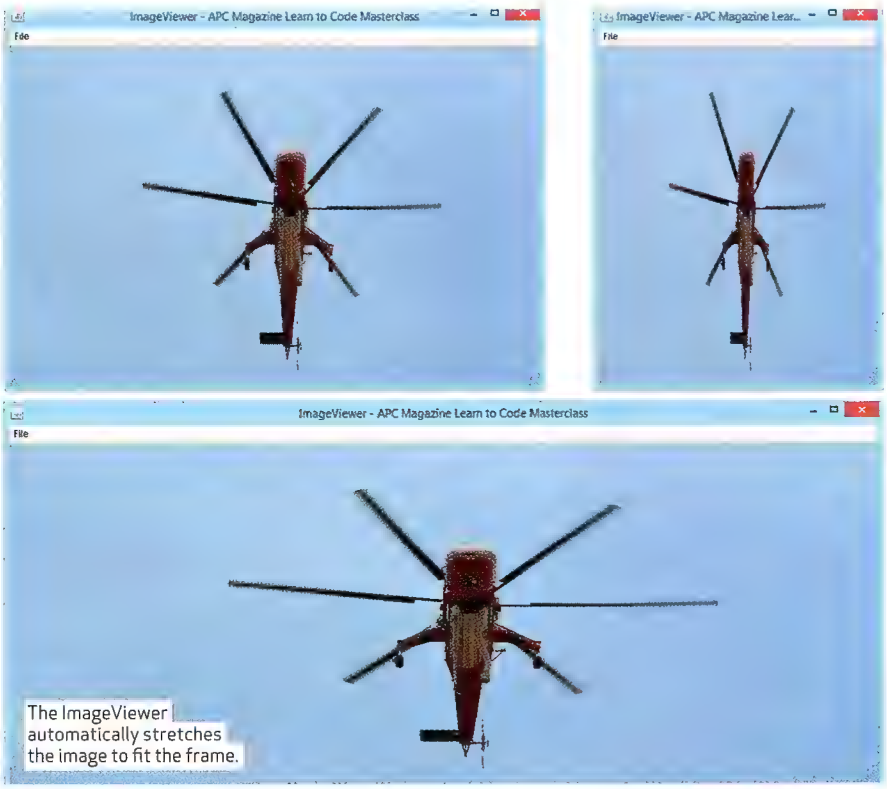
But right at the top of our app, we're introducing another important GUI concept – app menus. Every GUI app has one and adding them to Java apps, again, is relatively easy.

You start by creating a new JMenuBar object – we're calling ours (for want of a better name) 'menu'. Next, you add a JMenu object to your JMenuBar, which we've called 'fileMenu'. A JMenu is the vertical list of commands you see drop down when you select 'File' or 'Edit' in Windows Notepad or a squillion other apps.

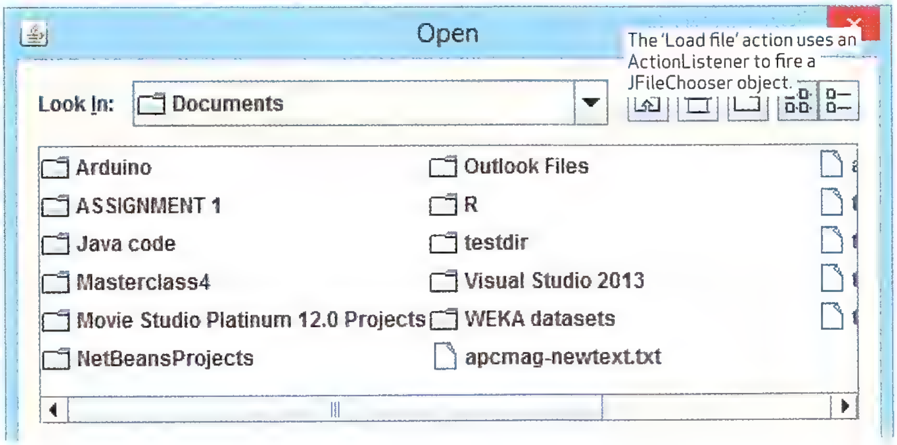

Open
Look In: Documents
Outlook Files
R
testdir
Visual Studio 2013
ects WEKA datasets
DSC_0097.JPG
DSC_0109.JPG
DSC_0110.JPG
DSC_0116.JPG
DSC_0202.JPG
innerborder.jpg
innerborder-sm.jpg
File Name:
Open
Cancel

Files of Type: Image files (.jpg, .png, .gif)

Using a filter allows you to show files of a particular type.


ImageViewer - APC Magazine Learn to Code Masterclass
File
ImageViewer - APC Magazine Lear...
File
ImageViewer - APC Magazine Learn to Code Masterclass
File

The ImageViewer automatically stretches the image to fit the frame.


Open
Look In: Documents
Arduino
ASSIGNMENT 1
Java code
Masterclass4
Movie Studio Platinum 12.0 Projects
NetBeansProjects
Outlook Files
R
testdir
Visual Studio 2013
WEKA datasets
apcmag-newtext.txt

The 'Load file' action uses an ActionListener to fire a JFileChooser object.

Once you've created a JMenu object, you add JMenuItems to it. So for our text editor, we've added four basic options – New, Load, Save and Exit. Each of these JMenuItems are added to the 'fileMenu' JMenu object, so when you click on the File menu, you'll see the 'New, Load, Save, Exit' options listed underneath.

But to get each of those JMenuItems to activate some part of our code, we go back to the ActionListener class we introduced last month. ActionListeners are the mortar that binds GUI components together. When you attach an ActionListener to a GUI component in your code, the ActionListener sits there, waiting for the user to press that control, which then activates your code to perform the task you've associated with it.

You'll see that we incorporated two types of ActionListeners into our Text Editor – named listeners such as 'LoadListener()' and 'SaveListener()', and anonymous listeners, where we simply create a 'new ActionListener()' object and attach the code we want it to run straight after the initial instantiation. Each option has its place, depending on the context in your code, so it's well worth understanding them both.

SAVING A TEXT FILE

With the app up and running, the user will type their text in the editor window, select File, then Save – but then what? The normal thing that happens when you choose to save a file in any Windows app is that you get a Save File dialog box, where the user selects the drive and folder location, along with the filename of the file.

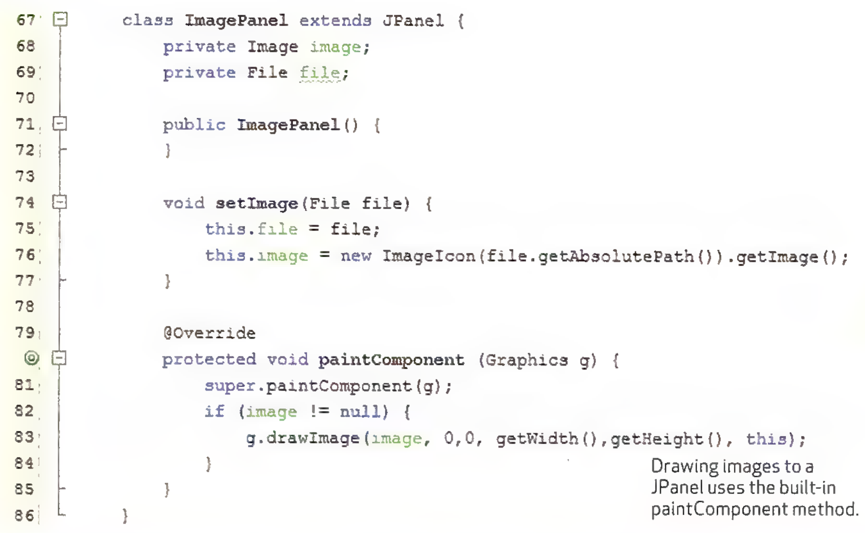
In Java, the first step is to create a JFileChooser object. Java uses the JFileChooser class for both Load and Save dialog boxes and you show the appropriate option by running either the JFileChooser.showOpenDialog() or JFileChooser.showSaveDialog() methods, respectively.

Take a look at the SaveListener class in our code and the first thing we do inside the compulsory actionPerformed method is create the 'fileChooser' JFileChooser object. We then create a FileNameExtensionFilter called 'filter' to have the dialog box show only files with a .txt suffix and attach that filter object to the fileChooser object.

The next line is key:

```
if (fileChooser.
showSaveDialog(null) ==
JFileChooser.APPROVE_OPTION) {
```

JFileChooser.APPROVE_OPTION is a Java constant and what the codeline is saying is that if the user presses the Save button in the Save dialog box,



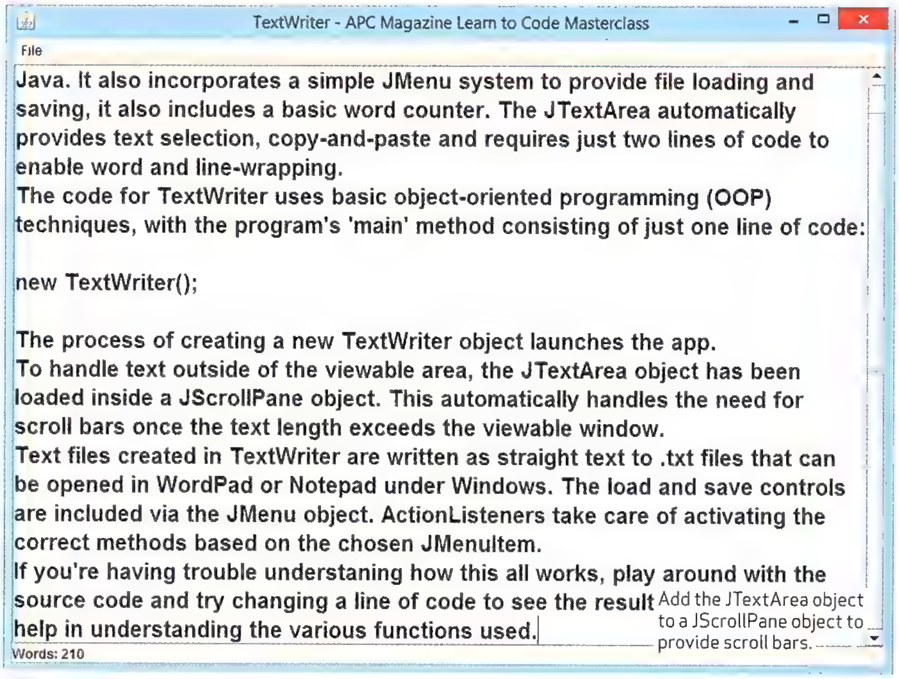
```
class ImagePanel extends JPanel {
    private Image image;
    private File file;

    public ImagePanel() {
    }

    void setImage(File file) {
        this.file = file;
        this.image = new ImageIcon(file.getAbsolutePath()).getImage();
    }

    @Override
    protected void paintComponent (Graphics g) {
        super.paintComponent(g);
        if (image != null) {
            g.drawImage(image, 0,0, getWidth(),getHeight(), this);
        }
    }
}
```

Drawing images to a JPanel uses the built-in paintComponent method.

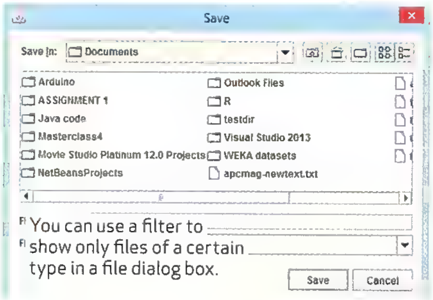


Java. It also incorporates a simple JMenu system to provide file loading and saving, it also includes a basic word counter. The JTextArea automatically provides text selection, copy-and-paste and requires just two lines of code to enable word and line-wrapping.
The code for TextWriter uses basic object-oriented programming (OOP) techniques, with the program's 'main' method consisting of just one line of code:

new TextWriter();

The process of creating a new TextWriter object launches the app.
To handle text outside of the viewable area, the JTextArea object has been loaded inside a JScrollPane object. This automatically handles the need for scroll bars once the text length exceeds the viewable window.
Text files created in TextWriter are written as straight text to .txt files that can be opened in WordPad or Notepad under Windows. The load and save controls are included via the JMenu object. ActionListeners take care of activating the correct methods based on the chosen JMenuItem.
If you're having trouble understaning how this all works, play around with the source code and try changing a line of code to see the result help in understanding the various functions used.

Add the JTextArea object to a JScrollPane object to provide scroll bars.



You can use a filter to show only files of a certain type in a file dialog box.

then perform the following actions. Obviously, if the user doesn't press the Save button (probably, the Cancel button instead), then we don't do anything.

The next step is to create a File object and assign to it the selected filename from the JFileChooser object. But before we march on blindly, we need to think about what's going to happen – if the user wishes to write to a file, what if that file already exists? After setting up the new File object, we then check to see if the file already exists and if so, ask the user via a JOptionPane dialog box with 'yes' and 'no' buttons whether or not they wish to overwrite the existing file. If the user says 'yes', we launch the 'writeFile' method and write the file. Otherwise, we do nothing.

WRITING DATA TO DISK

Methods are great for compartmentalising code functions and help make your code easier to read (and fix!). Here, we've moved the disk-writing code to another method called 'writeFile', to which, we pass the name of the File object (the filename of the file we want to write).

Actually, writing data – in this case, text – to disk takes just a few lines of code. First, we create a PrintWriter object we call 'output'. PrintWriter is a recent Java addition that makes text-file writing easy. We assign 'output' to a new PrintWriter object consisting of our file. We then write to disk the text in the JTextArea using the 'output.write' method and finally, close the 'output' object.

LOADING DATA FROM DISK

Loading a text file back into our Text Editor isn't much different. We start with the LoadListener class object, create a separate JFileChooser object called 'fileChooser' and ask the user to select the file. But in this case, rather than a PrintWriter object, we create a Scanner object to read the file. (You may remember back to early-on in this series, we used the Scanner class to read user input from the keyboard. Here, we read from the disk instead).

Once the Scanner object 'input' has been instantiated, we begin a while-loop and use the Scanner 'hasNext' method to check if we've reached the end of the file:

```
   while (input.hasNext())
text.append(input.
nextLine()+"\n");
```

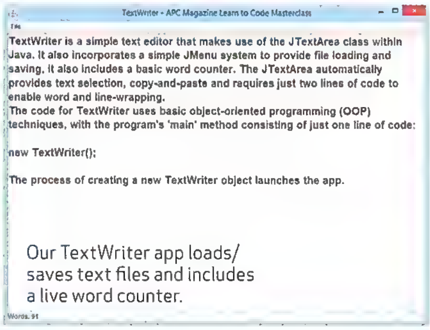
While the input object still has more data available (ie. hasNext), we read in the next line of text and append it to the JTextArea object we called 'text'. The '\n' is a shortcut for forcing a new line by adding a carriage-return, so that we keep paragraphs as the user added them.

When input.hasNext() is false (meaning we've reached the end of the file), we close the input Scanner object and launch the countWords() method to find out how many words there are.

COUNTING WORDS

The very last method in the source code for this project is the countWords() method and here, we're using a fairly basic technique of counting words – and that's by using the String.split() method, which takes a copy of the JTextArea text and splits it into an array of strings based on the delimiter option we put inside as the split parameter. Here, you'll see we've used an odd-looking '\\s' code – this is short-code for a space created by the keyboard space-bar. The result is each word becomes a new element within the 'textWords' String array, but to make things more memory-efficient, we convert this String array to an ArrayList of Strings via Array.asList() method – an ArrayList is similar to an array, except that you can add, insert and delete elements from an ArrayList. You can't do that with a standard array. But what's really cool is that we've done all this with just a single line of code.

Java has built-in classes to make reading and writing text files simple.



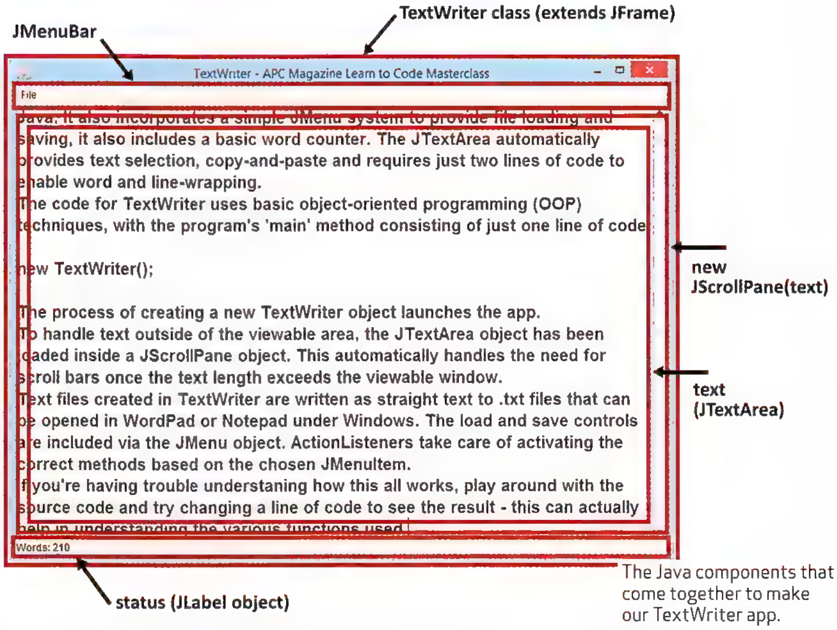
TextWriter is a simple text editor that makes use of the JTextArea class within Java. It also incorporates a simple JMenu system to provide file loading and saving. It also includes a basic word counter. The JTextArea automatically provides text selection, copy-and-paste and requires just two lines of code to enable word and line-wrapping.
The code for TextWriter uses basic object-oriented programming (OOP) techniques, with the program's 'main' method consisting of just one line of code:

new TextWriter();

The process of creating a new TextWriter object launches the app.

Our TextWriter app loads/saves text files and includes a live word counter.

Java class components in TextWriter app



Java. It also incorporates a simple JMenu system to provide file loading and saving, it also includes a basic word counter. The JTextArea automatically provides text selection, copy-and-paste and requires just two lines of code to enable word and line-wrapping.
The code for TextWriter uses basic object-oriented programming (OOP) techniques, with the program's 'main' method consisting of just one line of code

new TextWriter();

The process of creating a new TextWriter object launches the app.
To handle text outside of the viewable area, the JTextArea object has been loaded inside a JScrollPane object. This automatically handles the need for scroll bars once the text length exceeds the viewable window.
Text files created in TextWriter are written as straight text to .txt files that can be opened in WordPad or Notepad under Windows. The load and save controls are included via the JMenu object. ActionListeners take care of activating the correct methods based on the chosen JMenuItem.
If you're having trouble understaning how this all works, play around with the source code and try changing a line of code to see the result - this can actually help in understanding the various functions used.

TextWriter class (extends JFrame)
JMenuBar
TextWriter - APC Magazine Learn to Code Masterclass
File
new JScrollPane(text)
text (JTextArea)
Words: 210
status (JLabel object)

The Java components that come together to make our TextWriter app.

After that, we write to the status JLabel the number of words in the file by simply looking at the number of elements in the textWords ArrayList, since every word has become an array element. We do that by using the ArrayList.size() method, which in this case becomes textWords.size(). The very last line empties the list, so that we don't have a continuous ArrayList of strings chewing up memory.

Yep, the whole thing is incredibly crude, but it works well, as long as you're happy to count words as any text separated by a space character.

APP #2 – IMAGEVIEWER

To reinforce some of these concepts, our second app project this month is a simple image viewer we've imaginatively called 'ImageViewer'. A text editor and image viewer might sound poles apart, but taken from a big-picture viewpoint, there are similarities – both apps allow the user to load a file and display its contents. It's just that one displays text; the other images.

The difference with ImageViewer is that instead of a JTextArea, we use a JPanel to load images. Image manipulation can become as complex as you want, so for the sake of brevity, we're sticking to simple load-and-view.

EXTENDING A JPANEL

The key class is the ImagePanel class we've created that extends JPanel. JPanel objects have a built-in method called paintComponent that has a graphics object called 'g'. Here, we use the drawImage method to draw the image onto the ImagePanel. This isn't necessarily the best way to do what we're doing, but it's about as simple as you can make a basic image viewer.

LOAD AN IMAGE FILE

The initial mechanism for loading an image file is the same for loading a text file – or any file for that matter – if you're using a JMenu system. Here, we're using the LoadListener class, again, that implements our old mate, the ActionListener, so that when the user clicks File/Load, the app is ready to perform the load task.

And that load mechanism, again, is similar to the one in our TextWriter app – we launch a JFileChooser object using the 'showOpenDialog()' method to get the file the user wants to load. We also use the FileNameExtensionFilter class again, but instead of .txt files, this time, we want .JPG, .PNG and .GIF image files to show up.

Once the user selects a file, it becomes a File object that we pass onto the ImagePanel object using the 'setImage' method. That method also draws the image to the ImagePanel and the whole JPanel object is redrawn using the 'repaint()' method.

USING JAVA'S BUILT-IN FUNCTIONS

Apart from learning how to open and save text files, hopefully you've also seen that where ever possible, we've used the built-in functionality within each Java class component, for example, the JTextArea, JMenuBar and JFileChooser classes that provide a whole range of features and functionality for just a handful of lines of code.

Classes are the fundamental building blocks of Java (and other languages such as C#), providing the built-in functions of the language. And 'building blocks' is an apt description of them because classes can be expanded or 'extended' to create new classes, that become new (and importantly, reusable) building blocks. We did this with the ImagePanel, the LoadListener and SaveListeners classes.

What we're talking about here is skirting the edges of a concept that all but owns current-day coding – and that's Object-Oriented Programming (OOP). Next time, we'll flesh out our practice with theory that will give you the keys on OOP, how it works – as well as its benefits and drawbacks. ■

It's not too late!

It's never too late to learn to code — or join in our Learn to Code Masterclass! First, head to Oracle's web site (**tinyurl.com/76mgogl**), download and install the latest Java Development Kit (JDK) and NetBeans IDE bundle. The JDK provides the programming language and NetBeans, an easy-to-use but powerful development app you'll write your code in.

Once they're installed, grab the source code zip file you'll find each month on our *APC* web site at **apcmag.com/magstuff**, unzip the package and load the internal project zip files straight into NetBeans.

downtime

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> "Geralt is a big lumbering man with a tank-like turning circle. Timing rolls and heavy attacks can be tough, and slashing away irrespective of your opponent's power is never a good idea."

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The Witcher 3: Wild Hunt

Move over, *Skyrim*: open world RPGs have reached another level.

Velen is a miserable place. Geralt is here to find a woman, but there are several obstacles in his way, chief among them the destitution and poverty of the land. Bandits burn down peasant huts, drunk barons lord over swampy outposts, and there's no shortage of wolves, drowners and other nasty aggressors.

It's beautiful though. Velen, that is. A vast stretch of European pastoralism and Autumnal colours, this region is one of the richest open worlds committed to code. Marshes, quagmires and bramble forests give way to bright stretches of green countryside. A wide river courses through the land, and it's sometimes easy to forget just how corrupted the people living here are.

Corrupted is the key word when it comes to *The Witcher 3*, especially in its opening 30 hours. After leaving a (large by other games' standards) opening region called White Orchard, protagonist Geralt finds himself in Velen. It's always tempting to reference *Game of Thrones* when trying to convey a certain ruthlessness in fantasy RPG storytelling, but rarely has a game felt so alive with depravity. It hits a perfect note somewhere between high fantasy and bleak social realism – a subtle mix that isn't immediately obvious when you start the game. It helps that all of the town's settlements – ranging from depressing slum outposts through to the grand centrepiece Novigrad – feel eerily real. It puts *Assassin's Creed's* sprawling metropolises to shame.

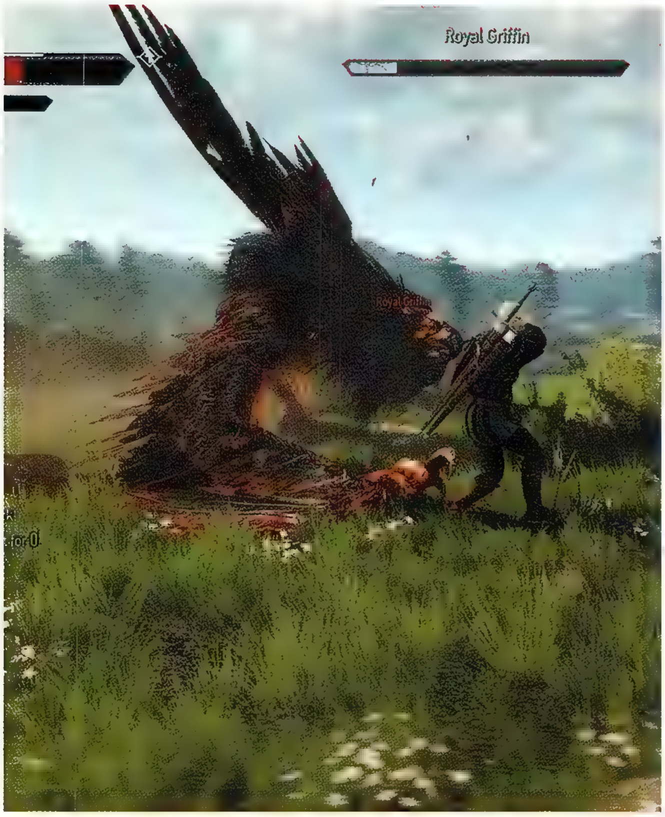
It's hard to convey without resorting to plot spoilers, but just rest assured that nothing is sacred, and the fact that some of these set pieces made it through Australia's notorious classification board is sometimes surprising. None of it feels exploitative or schlocky though: it's just a very violent, very adult RPG, with laboured emphasis on the word 'adult'.

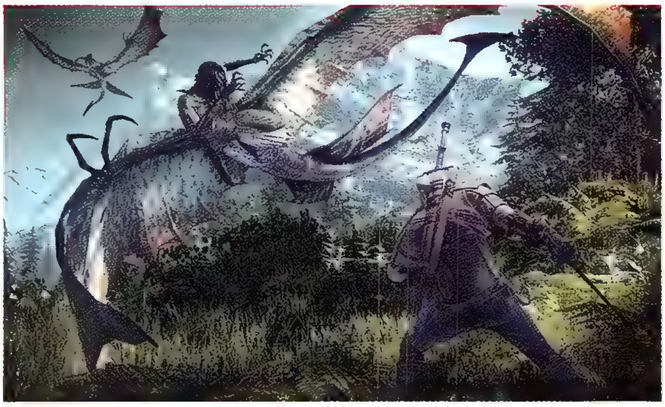
HACK AND SLASH

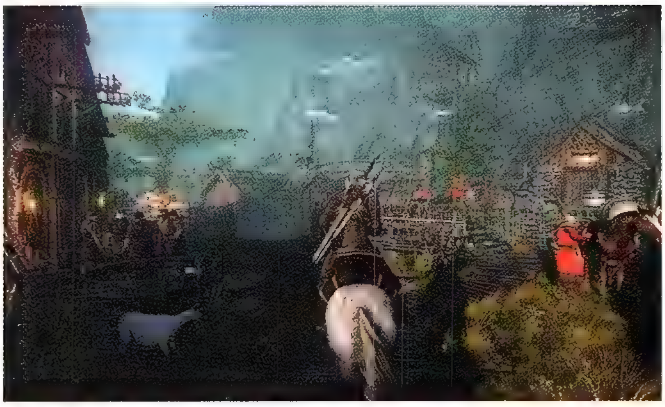
You won't need to have played the first two *Witchers* to enjoy this third instalment, but it will help you appreciate how detailed the setting and storytelling are. Geralt is the nominal Witcher, a gypsy-like monster slayer with magical abilities and other supernatural perks, such as heightened senses all the better for sniffing-out and solving mysteries.

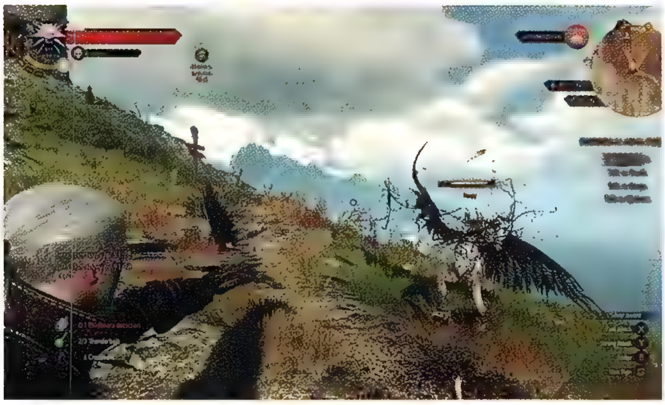
As such, you won't be building a character from scratch like in a lot of other RPGs: you're Geralt from beginning to end (with a few ultra-spoilerific exceptions). That doesn't mean there's a lack of specialisation: on the contrary, the game demands a solid grasp on how you want to specialise much sooner than say, *Dragon Age: Inquisition*. Geralt has four upgrade trees ranging combat, signs (ie, Geralt's magical powers), alchemy and 'general'. These are joined by a fifth category called Mutagens, which are basically high level equippable buffs. The twist is, when you're upgrading along one of these paths you'll only be able to equip a handful of them at once, starting with three at the beginning of the game and moving up to six. In this way, deciding whether you want to rely heavily on swordplay or magic is important, though it's always sensible to mix and match in the heat of combat. This makes early decisions in the game critical, but not potentially ruinous.

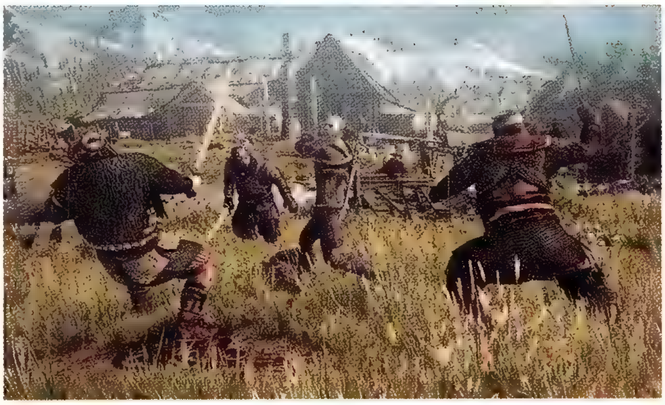
Combat is a hard slog at first, because Geralt is a big lumbering man with a tank-like turning circle. Timing rolls and heavy attacks can be tough, and slashing away irrespective of your opponent's power is never a good idea. In some ways it resembles the kind of slow and steady approach seen in *Dark Souls*, where no amount of power levelling will compensate for a











player's lack of patience and dexterity.

Mixing up Geralt's fire, magic or stun attacks with regular swordplay is a zen experience when executed right, but a poorly executed lock-on system too often ruins the flow, in its seeming inability to lock on to the enemy you want it to.

You'll engage in a lot of combat in the game's main quests. These are usually long, multi-arced narratives that feel like discreet feature films in the grander story. In fact, the quest structure is one of its cleverest assets, in the way it solves the problem of player freedom potentially undermining cohesion. Early in the game two major quests are accessible side-by-side, and each offers a nuanced take on a major character. It's obvious that Polish studio CD Projekt has laboured over how to present narrative in an engaging way, and it shows: this could be the new benchmark for RPG storytelling.

While it doesn't have the character customisation depth of a BioWare or Bethesda RPG, Geralt's dialogue, and the decisions you'll be asked to make on the fly, do offer a strong feeling of consequentiality, both moral and functional.

Sometimes Geralt is pressed with urgent questions requiring a quick response, and these aren't on trifling matters: they'll have irreversible consequences. And more often than not you'll feel it straight away.

IMPOSSIBLE HORIZONS

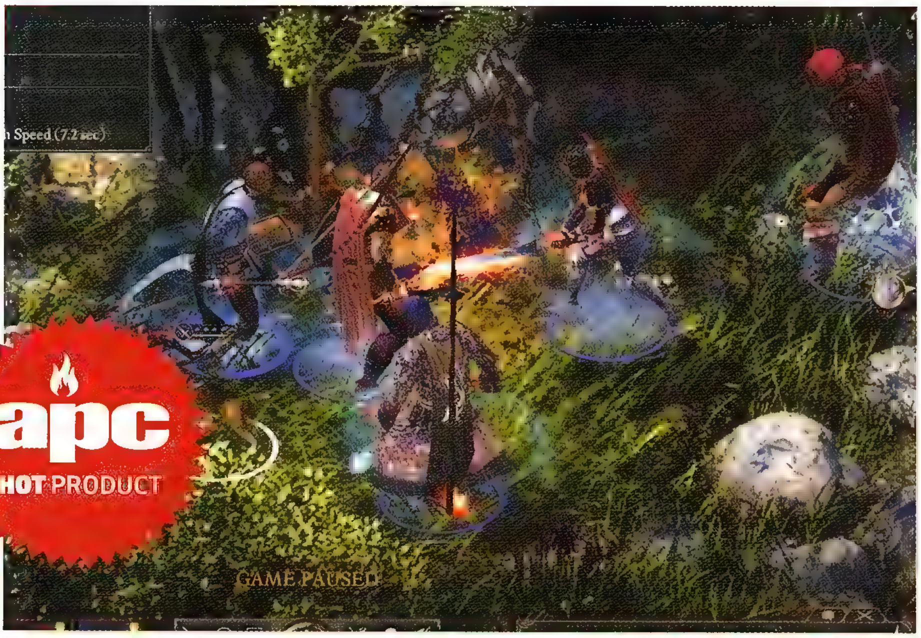
It needs to be stressed that *The Witcher 3* is vast. In addition to the rural Velen region, you'll also visit the grandiose Skellege Isles. While the size of the game's two main maps dwarfs many comparable RPGS (like *Skyrim*, for instance), that's not even the most impressive thing. The level of detail afforded the most insignificant areas feels almost supernatural, to the extent that it's difficult to imagine actual humans sitting at a desk, creating this. Wind and weather is uncanny, dynamic and beautiful. You can look at the sky and think "it's gonna rain soon".

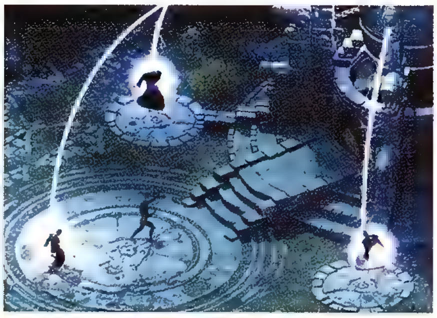
I can say with confidence that *The Witcher 3* is among the best looking games ever made, though it's not without its technical flaws on PS4: the framerate does play up in dense areas, but it's a rare occurrence and it never feels unjustified. That's the price you pay when playing a game like this on a console. I can also say with confidence that it's one of the biggest, most overwhelming and ambitious RPG projects ever created, with CD Projekt emerging as a true challenger to Bethesda's dominance in the genre. ■ **Shaun Prescott**

Verdict

A preposterously huge and engaging fantasy RPG that plays as well as it looks. That is, incredibly.

★★★★★





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Pillars of Eternity

The Kickstarted RPG that may stand forever.

A Kickstarter is not a guarantee. Many of us learned that the hard way. Looking at the list of games we've backed, it ranges from the disappointing (*Fist of Awesome*) to the misleading (*Godus*) to the never-appearing (*Clang!*). And if you backed the *Project Eternity* Kickstarter, which promised a return to the days of *Baldur's Gate*, you did so with the full knowledge that the developer Obsidian had a string of wonderful but mostly buggy projects to its name, so you shouldn't expect too much.

Perhaps the company's reputation for unfinished games was due to publisher pressure to finish on time. Because here, working at its own pace, Obsidian has excelled. *Pillars of Eternity* is a perfect recreation of that *Baldur's Gate* era. There's the mysterious plot and the character-soaked exploration team faced with endless side quests. There's the glorious city of Defiance, the subterranean crystals of Od Nua and the dragonbone-strewn woods of Crossing.

Crucially, though, it's been brought up to date, learning particularly from the more recent BioWare titles. Early in the game, for example, you acquire an abandoned castle, Caer Nua, which is in ruins. Much like *Mass Effect* or *Dragon Age*, you can upgrade it, acquire troops to guard it, and gain an income from it. The dungeon underneath it, Od Nua, feels almost as big as the rest of the game put together. But you might never go down there. The main quest – following your ability to speak to the dead and the mystery of children born without souls – is long enough. Even finishing the game, you could never explore half the side quests that *Pillars* has to offer.

Focusing on only the main quest, you'll take several days to get through it. Do all the side quests and a hundred hours could easily disappear. If you're an obsessive-compulsive hoarder, you may never stop playing.

The storyline is mature, too. The sadness of families at their doomed Hollowborn children, plus the desperation of leaders and individuals to find explanations and solutions, is both believable and sad, as are those taking advantage of the panic. It's heavy on the words, too. The language may occasionally spill into overly wrought fantasy babble, but that's rare. It's mostly plainly written, but there are novels of evocative language that fill in the descriptive gaps between the delightful art.

That complexity extends to the look. You'll probably play much of the game at maximum view distance, but it's well worth diving in sometimes to take in the detail of the world.

REALTIME COMBAT

Though you can talk your way through many situations, sometimes you can choose to or be forced to fight. Like *Icewind Dale* of yore, the combat system is, by default, fairly brutal – not at the *Dark Souls* level, but harder fights will require your absolute attention and use of the pause menu.

Combat is played out through a realtime system, where you can pause at any time to issue orders – exactly the classic *Infinity Engine* system from the old *Baldur's Gate* games. Characters can, if you're not careful, die permanently – which means an end to any associated quests – but you can create more generic adventurers to replace them, albeit without the unique story.

It's not perfect, mind. For example, it's hard to be aware of the various types of damage and their particular defences – such as crushing, slashing, piercing, burning and freezing – while in the middle of a fight. Unless you've lost a fight 10 times in a row or are playing on the hardest difficulty level, you can muddle through most combats. And the variety of spell options with a wizard, a priest or an overpowered druid is frankly bewildering, even before your wizard starts swapping grimoires.

Pillars of Eternity has taken so much from *Baldur's Gate*, but most of all it's taken the spirit of the *Infinity Engine* games, which had barely felt the touch of age, and applied modern polish.

■ **Daniel Griliopoulos**

Verdict

A staggering achievement; rich dialogue and characters carry you through a strange-but-familiar world.

★★★★★

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Bloodborne

Another bulky RPG by the best studio in the field.

Five years ago it would have seemed impossible for games like *Dark Souls 2* and *Bloodborne* to have the profile and sales they boast in 2015. But while many make a big deal about the series' stubborn difficulty and impenetrable narratives, the real secret to From Software's success is atmosphere. Rarely have games felt so mysterious, bewildering and – most importantly – sad, and with PS4 exclusive *Bloodborne* the studio is ladling the dread on even thicker, under the auspices of *Souls'* founder Hidetaka Miyazaki.

Developed concurrently, there's no doubting *Bloodborne* is a more ambitious game than the newly reissued as *Dark Souls 2: Scholar of the First Sin*. The latter looks aged already, and while the higher detailed textures and smoother framerates make for a better experience on new-gen consoles, you can tell *Bloodborne* was the studio's major project.

Where the surreal environments of *Dark Souls 2* feature a surplus of empty square rooms and seemingly useless halls, no space is wasted in *Bloodborne*, nor is the opportunity lost to decorate each nook and cranny with telltale signs of a depressed city.

Set in the broken Victorian-era city of Yharnam, *Bloodborne* recalls the breathtaking verticality of the original *Dark Souls*. Labyrinthine streets and lanes interconnect in unexpected ways, with dark forest gardens and poverty stricken outposts hugging closely to the central sprawl. *Dark Souls 2* was criticised for lacking this interconnectivity when it released last year, but it's really aiming for something different: it's a continent-spanning adventure, conveying a greater sense of distance and a more earthbound scale.

These environmental design choices dovetail with subtle differences in combat. *Bloodborne* demands an offensive approach and forces the player to forego a shield unlike the patience and defensiveness nature of *Dark Souls 2*. It's an important difference, because the bulk of *Bloodborne* is set during a single night, while there's no comparable sense of urgency in *Dark Souls 2*. In *Bloodborne* you're a malignant hunter, whereas in *Dark Souls 2* you're a cautious adventurer.

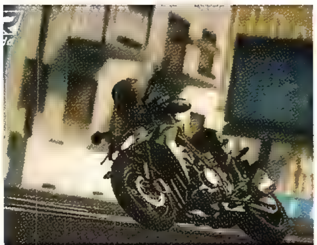
The real beauty of From Software's RPGs is their online components, and on new consoles these features shine. Nearly every NPC in a *Souls* game is sniggering, mean or else vaguely threatening, but the ability to summon real players to help with difficult situations feels like the only redemption in these otherwise bleak games. While *Bloodborne* arguably looks better and holds an olive branch to RPG shy players, it's difficult to establish a favourite between the two: both are minor masterpieces, in the way they convey emotions few other games can.

■ **Shaun Prescott**

Verdict

Two of the best RPGs of the last decade, but they'll make you rage!

★★★★★



Ride

A Polyphonicy spree, with bikes.

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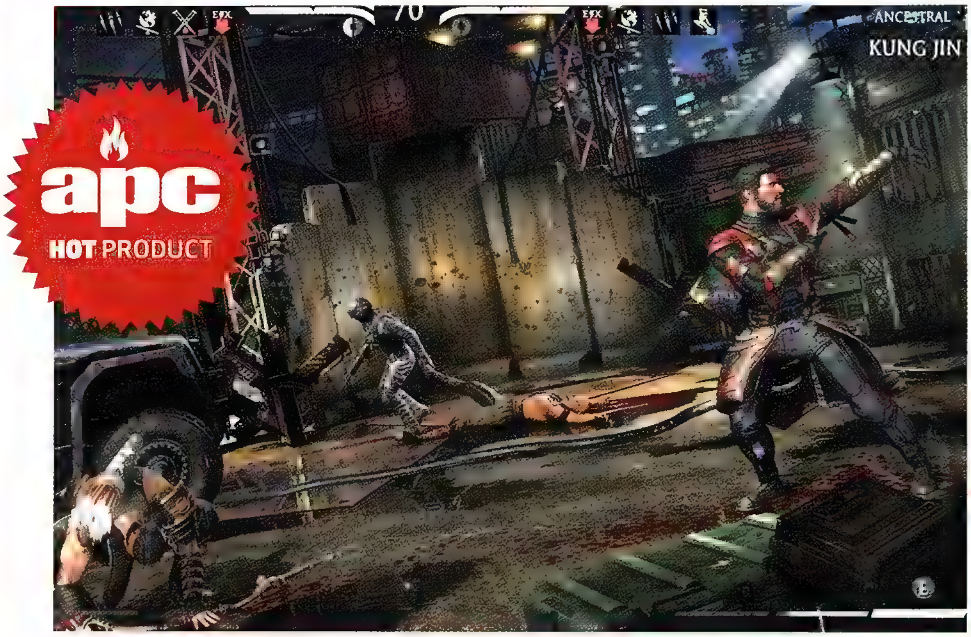
Here's how *Ride* operates. First, it suggests that it's a *Gran Turismo* facsimile on two wheels. And by the time you realise how far it falls short of that promise you've already spent too long changing the colour of your kneepads to just walk away from your commitment.

Created by *MotoGP* developer Milestone, *Ride* copies Polyphony's basic template to good effect early on. With a limited budget, you buy a low-powered naked bike from one of four categories which gains entry in a few races. Placing high in these earns money that can be spent on new bikes, upgrades, or new rider gear.

Naked bikes offer an accessible way in, putting up with a lot of aggressive braking and early acceleration but things get a lot more demanding in the increasingly powerful categories.

The foundations are solid, but *Ride* also makes silly mistakes. The rewind function's capability is so limited as to be almost useless, while opponent AI is processional. Collision detection between you and they also feels ropey and unconvincing, which diminishes the game's chops as a believable sim. As a bike racing fan you're hardly spoiled for choice right now, and it's worth a peek if you're not into *MotoGP* licensing, but it's lacking the depth of content offered by its four-wheeled inspiration.

■ **Phil Iwaniuk**



$79.95 | PC, PS3, PS4, X360, X1 | WWW.MORTALKOMBAT.COM

Mortal Kombat X

This union of savagery and spectacle is bruised by a sloppy port.

M*ortal Kombat* has always felt brutish when compared to the elegant flow of *Street Fighter 4*: heavy-fisted, filthy pub-fu, focused not just on defeating your opponent, but destroying them utterly. This is the most elegant incarnation of the game yet.

The returning super meter, borrowed from *Street Fighter*, adds complexity: you can interrupt an opponent's combo by using up two bars of the meter, creating an opening for a counterattack. X-ray moves are traumatic ultra combos, diverting a fight with damaging and humiliating specials. You quickly find yourself experimenting with X variations of familiar moves, tagging them onto the end of combos for increased damage.

Each fighter has three variations, similar to *Deadly Alliance* but without the option to switch during play. Scorpion's Inferno tricks him out with demonic minions, useful for zoning and gnawing ankles, Hellfire is an offensive build using fireballs and flame attacks, and Ninjutsu is his classic move set with added swords. Core specials are the same throughout, but be prepared for minor changes to your favourite characters. After five minutes spent trying to summon hellfire, worried I was fluffing it, I discovered it wasn't in the build I'd chosen. This might frustrate some, but it made me experiment with every variation.

Visually, the X-ray moves are a highlight, full of detailed splintering spines and skulls that crack like Easter eggs, while the backgrounds incorporate contextual attacks, letting me throw old ladies at my enemies. However, there are PC-specific problems. Screen tear was apparent regardless of the mandatory VSync. Fights run at a buttery 60fps, but cutscenes and X-ray moves drop it to 30fps. More worryingly, I had trouble making the game playable on a machine that met the minimum specs.

Online, it's even shakier. At least a third of my ranked matches choked and died, usually at the point things became interesting. Much like the offline game, it's more frustrating because the ideas are so promising: there are stacks of competitive options, from standard player matches to winner-stays-on king of the hill. Matches also inform an ongoing faction war, but it's difficult to remain engaged in a pretend ninja feud when every third match creaks like a shopping trolley dragged from a bog. Each frame in a fighting game matters, and *Mortal Kombat's* online component simply isn't sturdy enough to remain competitive.

Challenge towers function like arcade mode, setting you against a number of increasingly difficult opponents. Pleasingly daft variations like Test Your Luck throw in a new modifier every round, anything from tilting stages to exploding enemies. Even the Krypt, which houses all the unlockable goodies, is a first-person adventure through classic *Mortal Kombat* locations rather than just tedious menus. DLC and pre-order characters are trickier. They're present in every fighting game, but it's miserable to see Goro smiling at you from the character select screen, like a smug, premium-priced prick.

This is the most complete *Mortal Kombat* ever, but the limping port may lessen the experience for anyone without a godlike machine.

■ **Matt Elliott**

KENSHI
LIU KAN

Verdict

A fine fighter with an enjoyably daft story and masses of content, but marred by wobbly porting to PC.

★★★½

THE
MOST FUN
YOU CAN
HAVE WITH
YOUR HANDS
WITHOUT
GOING
BLIND

games
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MORE KICKS PER CLICK

Elderly computer shot to death

Man faces charges over permanent PC 'shutdown'.

A Colorado Springs man is facing charges over the fatal shooting of an old Dell computer. Police responded to a call of 'shots fired' to find shooter Lucas Finch, 37, standing over the victim holding a 9mm pistol.

By all accounts, Hinch had become frustrated by the aging computer's constant crashes, with a 'Blue Screen of Death' message being the inciting incident that pushed Hinch past breaking point.

Evidence suggests that the computer murder was premeditated – Hinch reportedly purchased the handgun from a seller on Craigslist in preparation for the shooting. The computer was just two days from retirement.

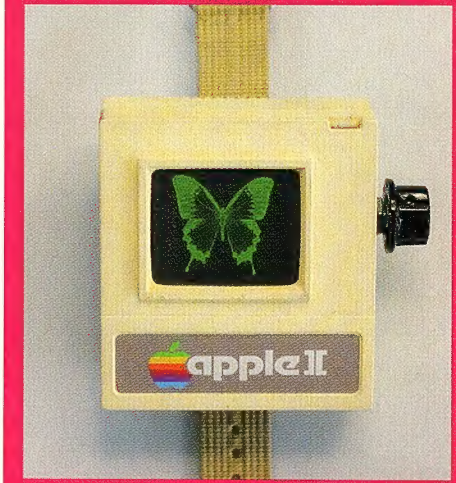
Candy Crush
SAGA

THUMB CRUSH SAGA

MAN RUPTURES THUMB TENDON FROM EXCESSIVELY PLAYING CANDY CRUSH

A 29-year-old California man has suffered a ruptured tendon in his thumb (and possibly a ruptured reputation amongst his mates) due to playing the popular smartphone game *Candy Crush Saga* non-stop for six to eight weeks (killing time while waiting for a package?). The man said that he used his left hand to play the game, and his right hand for other things (we don't want to know).

The man apparently did not feel pain while playing. A case study suggests that the pleasure of playing *Candy Crush Saga* may have caused his body to release natural painkillers.



Move over Apple Watch

APPLE II WATCH IS HERE!

Think the Apple Watch is a little too modern? Why not build your own '80s-style watch based on the iconic Apple II desktop computer? Instructables user Aleator777 has done just that, providing step-by-step instructions. Inside the Apple II Watch's beige, 3D printed plastic shell, is a Teensy 3.1 microcontroller that performs minor computing functions, such as real time and date. The watch also has a 1.8-inch LCD screen that displays everything in black and green, just like the Apple II. And, just like the real Apple Watch, it has a dial on the side to cycle through settings.

Chess cheat uses toilet iPhone

CHEATING IN A BATHROOM STALL NO LONGER INVOLVES SEX WITH A STRANGER

Uproar at the Dubai Open 2015 chess tournament, as Georgian chess Grandmaster Gaioz Nigalidze was caught using his iPhone to cheat during a major match. His opponent, Armenia's Grandmaster Tigran L. Petrosian, noticed Nigalidze constantly excusing himself to the bathroom before every move on the board. Petrosian alerted match officials, who initially found nothing on Nigalidze, but eventually found an iPhone and headset in the bathroom stall that he was frequenting. Nigalidze's attempts to deny ownership of the iPhone were fruitless — it was logged into his Facebook account. Nigalidze now faces a three year ban from all chess tournaments. ■

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